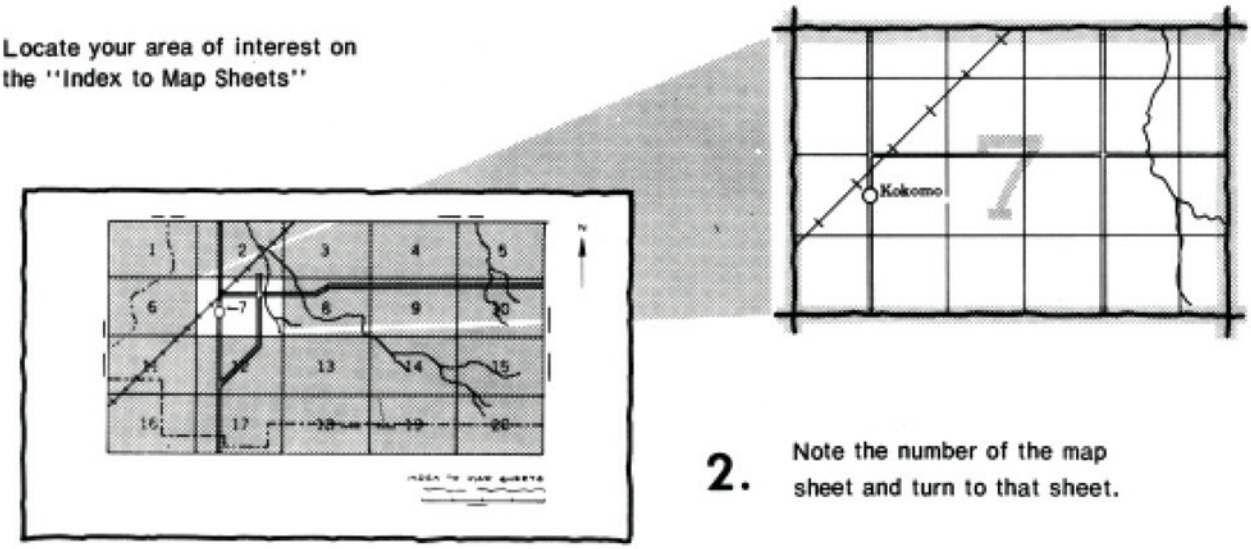
Soil survey of

Sanborn County South Dakota

United States Department of Agriculture
Soil Conservation Service
in cooperation with
South Dakota Agricultural Experiment Station

HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"



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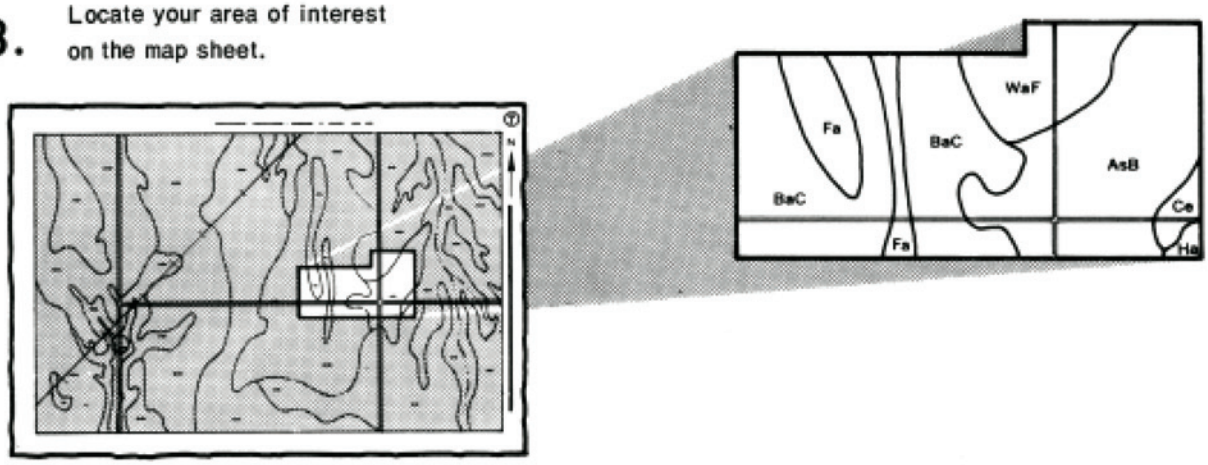

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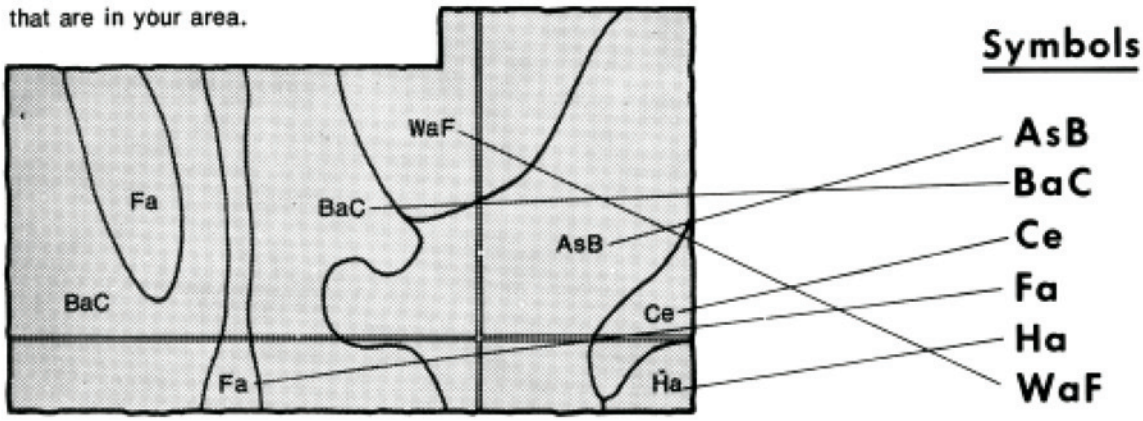
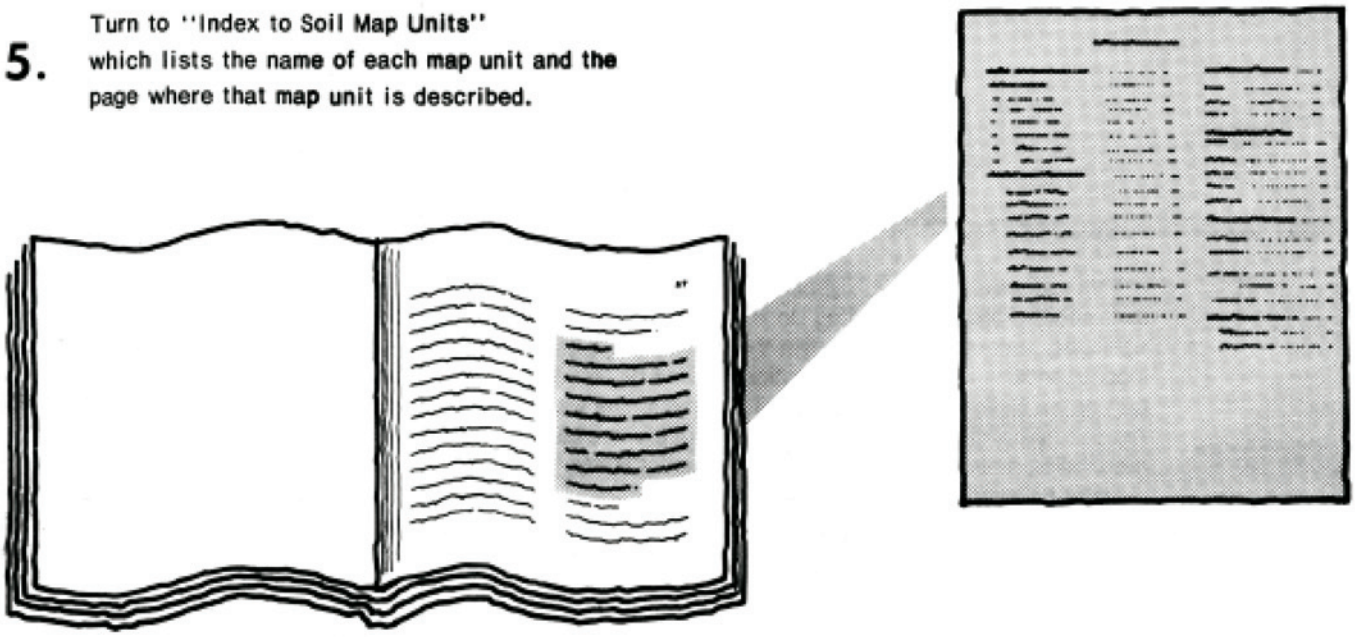
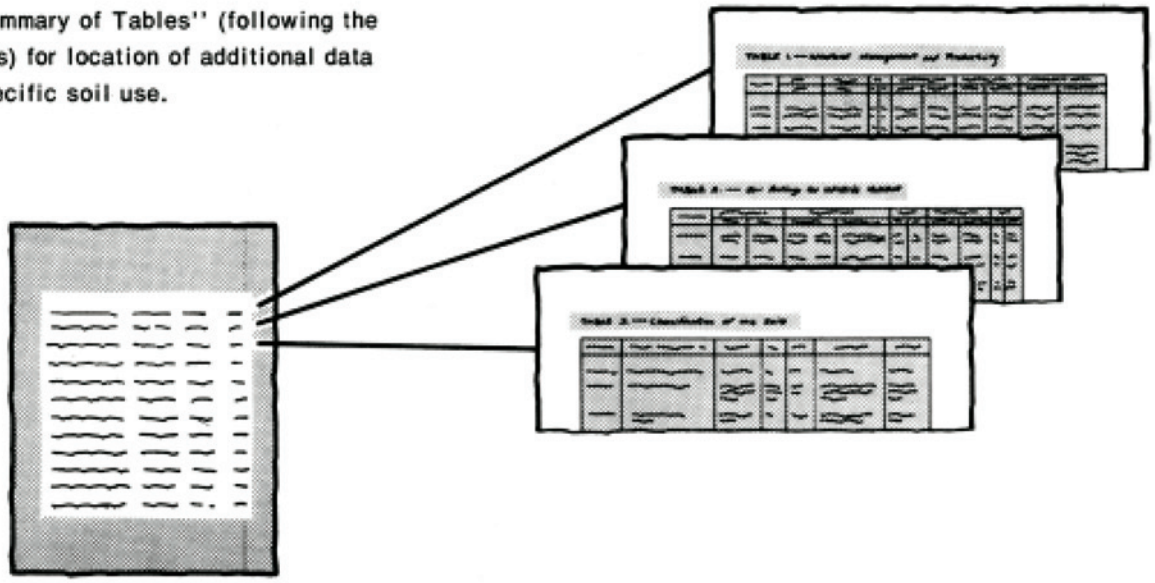


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Sanborn County Conservation District. Financial assistance was furnished by the Sanborn County Commissioners, the South Dakota Department of Revenue, and the Old West Regional Commission. Some technicial assistance was provided by the South Dakota Division of Conservation. Major fieldwork was performed in the period 1975-1978. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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foreword

This soil survey contains information that can be used in land-planning programs in Sanborn County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

R. D. Swenson

Robert D. Swenson
State Conservationist
Soil Conservation Service

soil survey of
Sanborn County, South Dakota

By James L. Driessen, Soil Conservation Service

Soils surveyed by James L. Driessen and Richard L. Schlepp,
Soil Conservation Service, and Wayne L. VanderVorste, South Dakota
Division of Conservation

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the South Dakota Agricultural Experiment Station

SANBORN COUNTY is in the east-central part of South Dakota (fig. 1). It has a total area of 365,440 acres, which includes about 885 acres of water. According to the 1970 census, it has a population of 3,697. Woonsocket, the county seat, in the northwestern part of the county, had a population of 852 in 1970, Artesian 277, Forestburg 129, and Letcher 201.

About 62 percent of the acreage is cropland, and about 33 percent supports native grass. Corn, oats, grain sorghum, and alfalfa are the main crops. Farming is diversified; livestock is the main source of income, but income from cash crops also is important.

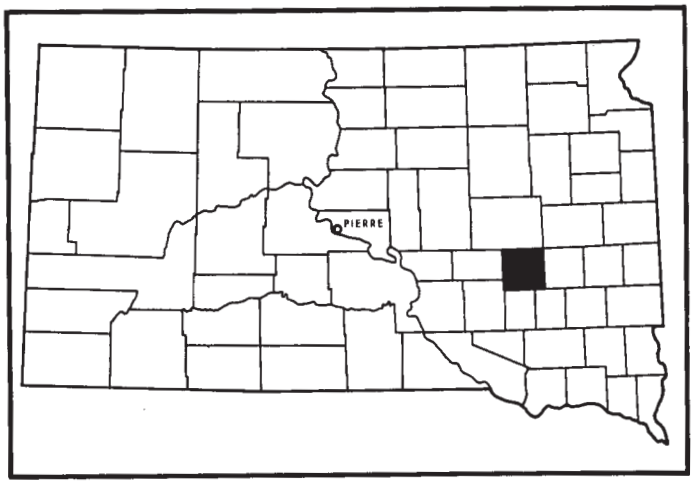

Figure 1.—Location of Sanborn County in South Dakota.

general nature of the county

This section gives general information concerning the county. It describes climate, physiography and relief, settlement, farming, and natural resources.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Sanborn County is usually quite warm in summer, but hot spells are frequent and cool days occasional. The county is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls during the warm period, and rainfall is normally heaviest late in spring and early in summer. Winter snowfall is normally not too heavy, and it is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Forestburg in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 18 degrees F, and the average daily minimum temperature is 8 degrees. The lowest temperature on record, which occurred at Forestburg on January 19, 1970, is minus 32 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Forestburg on July 10, 1966, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 21.45 inches. Of this, 16 inches, or 75 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 3.78 inches at Forestburg on July 4, 1957. Thunderstorms occur on about 40 days each year, and most occur in summer. Hail falls in scattered small areas during some of these storms.

Average seasonal snowfall is 34 inches. The greatest snow depth at any one time during the period of record was 45 inches. On an average of 35 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 14 miles per hour, in April.

physiography and relief

Sanborn County lies within the James River Basin (*4*). The elevation ranges from about 1,200 feet above sea level along the James River to about 1,370 feet in the northeastern part of the county. Most areas are nearly level to undulating, but hilly and steep areas are along the James River and some of the more deeply entrenched drainageways. The county is drained by the James River and its tributaries.

settlement

In 1873, a group of pioneers settled along the banks of the James River in an area of what is now known as Sanborn County. The county was formally organized by an act of the Dakota Territorial Legislature in 1883. The area then known as Miner County was divided into two parts; the eastern half remained Miner County, and the western half became Sanborn County. The Territorial Legislature named the county after George W. Sanborn, a railroad official.

The rate of settlement increased rapidly after railroad lines were extended into the county in 1882. Woonsocket, which is on a railroad junction, was incorporated as a town in 1884. The county had as many as 15 small settlements during the early days, but most of these have long since been abandoned. Communities remaining are Woonsocket, Letcher, Artesian, and Forestburg.

The population of the county increased from 4,610 in 1890 to a high of 7,877 in 1920. It gradually declined to a low of about 3,000 by 1955. By 1970, it had increased to 3,697. All of the population is rural.

One railroad presently serves the county. South Dakota Highway 34 crosses the county from east to west and South Dakota Highway 37 from north to south.

farming

In 1975, 360,400 acres in Sanborn County was farmland. This is more than 98 percent of the total acreage. The 530 farms averaged 680 acres in size. The average size has gradually increased since 1935.

Corn, oats, grain sorghum, spring wheat, barley, and alfalfa are the main crops. In 1975, corn for grain was harvested on about 31,000 acres, oats on 34,000 acres, grain sorghum on 5,000 acres, spring wheat on 4,700 acres, barley on 4,500 acres, alfalfa hay on 36,000 acres, wild hay on 28,000 acres, and rye on a small acreage. About 28 percent of the total farm income is from the sale of cash crops and 72 percent from the sale of livestock and livestock products (*5*).

Vegetables are harvested each year on a small acreage of the sandy soils in the central and west-central parts of the county. Watermelons, muskmelons, squash, pumpkins, and cucumbers are the most extensively grown vegetables. Most of this produce is marketed locally.

natural resources

Soil is the most important natural resource in the county. It provides a growing medium for the grass grazed by livestock and for cultivated crops. Other important natural resources are ground water and sand and gravel.

Ground water in quantities large enough to supply farm wells is available in most parts of the county. An estimated 2,200,000 acre-feet of water is stored in two large, shallow ground aquifers in the western and northern parts (*6*). This water generally is suitable for irrigation, but the quality varies greatly within short distances. Deep wells, which penetrate aquifers in bedrock, provide water under artesian pressure in most parts of the county. Water from the bedrock aquifers is unsuitable for irrigation because of a high content of sodium and boron.

Large glacial outwash deposits of sand and gravel are in the central and western parts of the county. They consist mainly of fine to coarse sand and some gravel, silt, and clay. The sand and gravel generally contains excessive amounts of fine rock fragments, such as shale, chalk, and clay ironstone, making it unsuitable as concrete aggregate or construction material. It is suitable, however, as subgrade material for roads and as bituminous aggregate. Much of the wind-laid fine sand in central Sanborn County is suitable for use in making mortar or plaster.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows the soil associations in this county. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 10 associations in this county have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. The names of some associations do not agree with those on the general soil maps in the published soil surveys of adjacent Beadle, Davison, Hanson, and Jerauld Counties. The names do not fully agree because of differences in the detail of the general soil maps and because of changes in the application of the soil classification system.

moderately well drained to poorly drained, nearly level soils

These soils are in broad, low lying areas on uplands. They dominantly are nearly level. They have a silty, clayey, or loamy surface layer and generally have a subsoil that is high in content of sodium.

These soils make up about 6 percent of the county. About 90 percent of the acreage is range. A few areas are used for forage crops.

1. Durrstein-Artesian-Farmsworth association

Moderately well drained to poorly drained, nearly level, silty, clayey, and loamy soils in drainageways and upland basins

This association is in drainageways and in broad, low lying areas in upland basins. The drainage pattern is poorly defined. Slopes are 0 to 2 percent.

This association makes up about 6 percent of the county. It is about 50 percent Durrstein soils, 15 percent Artesian soils, 15 percent Farmsworth soils, and 20 percent minor soils.

The poorly drained Durrstein soils are in broad, flat drainageways and in concave areas in the broad upland basins. Typically, the surface layer is gray silt loam. The sodium affected subsoil is dark gray and gray, very firm clay. The underlying material is gray, mottled, calcareous clay and silty clay.

The moderately well drained Artesian soils are in broad upland basins. Typically, the surface layer is dark gray silty clay. The subsoil is very dark gray, dark gray, and gray, very firm, calcareous clay. The underlying material is gray, mottled, calcareous clay.

The somewhat poorly drained Farmsworth soils are in shallow swales and depressions in broad upland basins. Typically, the surface layer is dark gray loam. The subsurface layer is gray clay loam. The sodium affected subsoil is dark gray and gray, very firm, calcareous clay. It is mottled in the lower part. The underlying material is grayish brown, light gray, and light brownish gray, mottled, calcareous clay and sandy clay loam.

Minor in this association are the nearly level, poorly drained Fedora soils in basins adjacent to the Durrstein soils; the well drained Hand and Ethan soils on the higher ridges and along drainageways; the somewhat poorly drained Lute soils on the lower parts of the landscape; and the moderately well drained Whitelake and Woonsocket soils on low mounds and ridges.

About 90 percent of this association is range. Tame pasture and hay and feed and forage crops are the main crops. Sorghum is grown in places. The main concerns of management are improving water intake and tilth and conserving moisture. Flooding is a concern in areas of the Durrstein and Farmsworth soils.

This association is poorly suited to cultivated crops and to openland wildlife habitat. It is fairly well suited to range, rangeland wildlife habitat, and tame pasture and hay. It generally is poorly suited to building site development and sanitary facilities because of flooding, a very high or high shrink-swell potential, and restricted permeability.

somewhat excessively drained to somewhat poorly drained, nearly level to moderately sloping soils

These soils generally are on glacial outwash plains and uplands that are characterized by many shallow swales. The moderately sloping soils are along drainageways. All of the soils are loamy or sandy. Most are nearly level or gently sloping. The drainage pattern is poorly defined in most areas.

These soils make up about 21 percent of the county. About 75 percent of the acreage is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops. Melons, squash, and pumpkins are grown in some areas.

2. Alwilda-Woonsocket-Blendon association

Somewhat excessively drained to moderately well drained, nearly level and gently sloping, loamy soils on outwash plains and on uplands

This association is on glacial outwash plains and on uplands characterized by many shallow swales. The drainage pattern is poorly defined.

This association makes up about 4 percent of the county. It is about 35 percent Alwilda soils, 25 percent Woonsocket soils, 20 percent Blendon soils, and 20 percent minor soils.

The somewhat excessively drained Alwilda soils are on outwash plains. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray fine sandy loam. The subsoil is dark grayish brown and grayish brown, very friable fine sandy loam and loamy fine sand. The underlying material is multicolored, calcareous gravelly sand.

The moderately well drained Woonsocket soils are in slightly concave areas on uplands. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is dark gray, dark grayish brown, and grayish brown, friable fine sandy loam and firm sandy clay loam. It is mottled in the lower part. The underlying material is light brownish gray and brown, mottled, calcareous loamy fine sand and fine sand.

The well drained Blendon soils are in plane and slightly convex areas on uplands. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray fine sandy loam. The subsoil is dark grayish brown and dark brown, friable fine sandy loam. The underlying material is brown loamy fine sand.

Minor in this association are the well drained Ethan and Hand soils in the higher convex areas; the poorly drained Clamo and somewhat poorly drained Wann soils on flood plains; the nearly level, poorly drained Durrstein and Fedora soils on uplands; and the poorly drained Tetonka Variant and poorly drained and very poorly drained Worthing soils in depressions.

About 95 percent of this association is used for cultivated crops and tame pasture and hay. Corn, oats, alfalfa, and grain sorghum are the main crops. The main concerns of management are controlling soil blowing and conserving moisture.

This association is fairly well suited to cultivated crops and to openland wildlife habitat. It is well suited to tame pasture and hay, range, and rangeland wildlife habitat. It is well suited or fairly well suited to most kinds of building site development and is poorly suited to most sanitary facilities because the effluent can seep through the sandy underlying material and pollute shallow ground water.

3. Carthage-Hand-Ethan association

Moderately well drained and well drained, nearly level and gently sloping, loamy soils on uplands

This association is on uplands characterized by many swales and scattered depressions. The drainage pattern is poorly defined in most areas.

This association makes up about 9 percent of the county. It is about 40 percent Carthage and similar soils, 35 percent Hand and similar soils, 10 percent Ethan soils, and 15 percent minor soils.

The moderately well drained Carthage soils generally are in concave areas on the lower side slopes and in the flatter areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is grayish brown, very friable fine sandy loam. The underlying material is light olive brown, mottled loamy fine sand over pale yellow, mottled, calcareous clay loam.

The well drained Hand soils are on slight rises. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is light yellowish brown loam. The underlying material is stratified, calcareous loamy sediments.

The well drained Ethan soils are on convex ridges and the upper side slopes along drainageways. In this association they have a slope of 2 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown and light brownish gray, friable loam and silt loam. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous silt loam, loam, and very fine sandy loam. It is stratified in the lower part.

Minor in this association are the moderately well drained Bonilla, Davison, and Woonsocket soils in swales and near the edges of depressions and the poorly drained Durrstein, Fedora, Tetonka, and Tetonka Variant soils in low lying drainageways and in depressions.

About 80 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops. The main concerns of management are controlling soil blowing, conserving moisture, and improving fertility.

This association is well suited to range and to tame pasture and hay and rangeland wildlife habitat. It is fairly

well suited to cultivated crops, to openland wildlife habitat, and to most kinds of building site development. It is fairly well suited or poorly suited to most sanitary facilities.

4. Forestburg-Shue-Elsmere association

Moderately well drained and somewhat poorly drained, nearly level to moderately sloping, sandy soils in swales and depressions and in other areas on uplands

This association is on uplands characterized by many swales, poorly defined drainageways, and small depressions. In areas of the Forestburg soils, slopes are short and slightly convex and commonly border the small depressions and drainageways. In areas of the Shue and Elsmere soils, they are slightly concave or smooth.

This association makes up about 8 percent of the county. It is about 30 percent Forestburg and similar soils, 25 percent Shue soils, 25 percent Elsmere and similar soils, and 20 percent minor soils (fig. 2).

The moderately well drained Forestburg soils are in the higher areas on the landscape. Slopes range from 0 to 9 percent and are steepest along the drainageways. Typically, the surface layer and subsurface layer are dark grayish brown loamy fine sand. Next is a transitional layer of grayish brown loamy fine sand. The underlying material is brown loamy fine sand over light brownish gray, mottled, calcareous loam and clay loam.

The somewhat poorly drained Shue soils are in swales and slightly depressed areas. Slopes range from 0 to 2 percent. Typically, the surface layer and subsurface layer are dark grayish brown loamy fine sand. The underlying material is light olive brown, mottled loamy fine sand over light brownish gray and light gray, mottled, calcareous clay loam and loam.

The somewhat poorly drained Elsmere soils have a slope of 0 to 2 percent. Typically, the surface layer and subsurface layer are dark gray loamy fine sand. The next layer is dark grayish brown, mottled loamy fine sand. The underlying material is light brownish gray and light gray, mottled, calcareous loamy fine sand, fine sand, and stratified silt loam and very fine sandy loam.

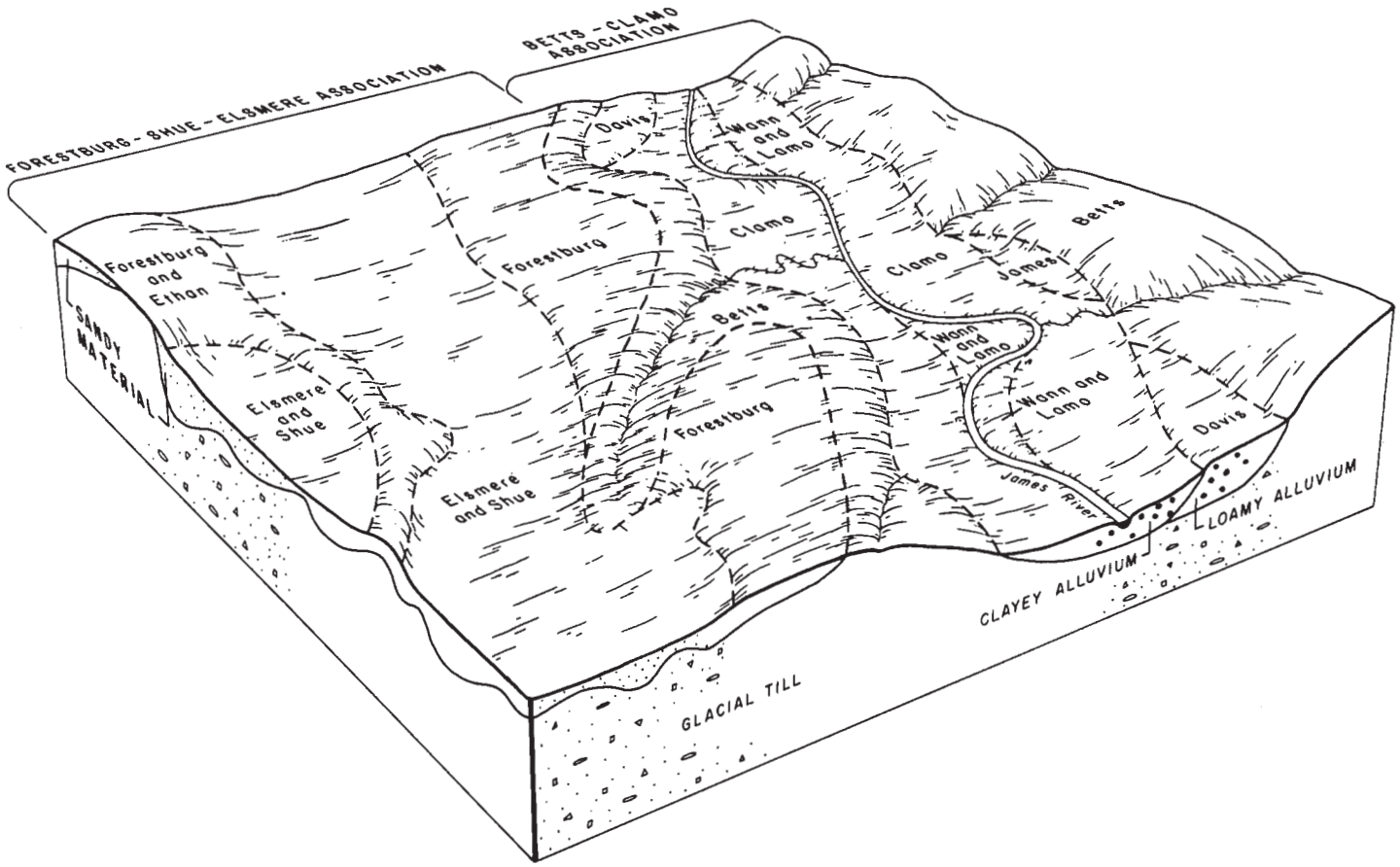

Figure 2.—Pattern of soils in the Forestburg-Shue-Elsmere and Betts-Clamo associations.

Minor in this association are the moderately well drained Davison Variant soils, the somewhat poorly drained Lute and Wann soils, the well drained Ethan and Hand soils, the somewhat excessively drained Doger soils, the excessively drained Valentine soils, and the poorly drained Orwet soils. The Doger, Ethan, Hand, and Valentine soils are in the higher areas on the landscape. The Davison Variant soils are on rises. The Lute and Orwet soils are in low areas. The Wann soils are on flood plains.

About 60 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and grain sorghum are the main crops. Melons, squash, and pumpkins are grown in some areas. The main concerns of management are controlling soil blowing and conserving moisture.

This association is fairly well suited to cultivated crops and to openland and rangeland wildlife habitat. It is well suited to range and to tame pasture and hay. It is fairly well suited to poorly suited to most kinds of building site development and poorly suited to sanitary facilities. The Forestburg soils are somewhat better building sites than the Shue and the Elsmere soils because they are not so poorly drained.

well drained to poorly drained, level to moderately sloping soils

These soils are in swales, depressions, and other areas on uplands. All of the soils are loamy and silty. Most are nearly level or undulating. The steeper soils are along drainageways.

These soils make up about 69 percent of the county. About 69 percent of the acreage is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops.

5. Houdek-Stickney association

Well drained and moderately well drained, nearly level, loamy soils on uplands

This association is on uplands characterized by slight rises, swales, and many scattered small depressions. It makes up about 4 percent of the county. It is about 50 percent Houdek soils, 25 percent Stickney soils, and 25 percent minor soils.

The well drained Houdek soils are in the higher convex areas. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam. It is calcareous in the lower part. The underlying material is pale yellow and light yellowish brown, calcareous clay loam.

The moderately well drained Stickney soils are in low concave areas and in swales. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsurface layer is grayish brown silt loam. Next is a transitional layer of dark grayish brown silty clay loam and light brownish gray silt loam. The subsoil is very dark gray and grayish brown, firm silty clay, clay, and clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown and pale yellow, calcareous clay loam.

Minor in this association are the moderately well drained Davison, Dudley, and Prosper soils; the somewhat poorly drained Jerauld soils; and the poorly drained Hoven, Tetonka, and Worthing soils. The Davison soils are on rims around depressions. The Dudley, Jerauld, and Prosper soils occur as areas intermingled with areas of the Stickney soils. The Hoven, Tetonka, and Worthing soils are in the depressions.

About 95 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops. Conserving moisture and improving tilth and fertility are the main concerns of management.

This association generally is well suited to cultivated crops and to tame pasture and hay, range, and rangeland and openland wildlife habitat. It is fairly well suited or poorly suited to building site development and poorly suited to septic tank absorption fields.

6. Clarno-Prosper-Tetonka association

Well drained, moderately well drained, and poorly drained, nearly level and level, loamy and silty soils on rises, in swales, and in depressions in the uplands

This association is on uplands characterized by slight rises, narrow swales, and drainageways that terminate in numerous small depressions. It makes up about 11 percent of the county. It is about 45 percent Clarno soils, 30 percent Prosper soils, 10 percent Tetonka and similar soils, and 15 percent minor soils.

The well drained Clarno soils are on the slight rises. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is olive brown, light olive brown, and pale yellow, friable clay loam and loam. It is calcareous in the lower part. The underlying material is pale yellow, calcareous loam.

The moderately well drained Prosper soils are in the swales. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark gray and dark grayish brown, firm clay loam over light yellowish brown, friable, calcareous clay loam. The underlying material is light gray and light brownish gray, mottled, calcareous loam and clay loam.

The poorly drained Tetonka soils are in the depressions. Slopes are 0 to 1 percent. Typically, the surface layer is gray silt loam. The subsurface layer is light gray, mottled silt loam. Next is a transitional layer of light gray silt loam and dark gray silty clay. The subsoil is dark gray, gray, and light olive gray, very firm, calcareous silty clay. It is mottled in the lower part. The underlying material is light gray, mottled, calcareous clay loam.

Minor in this association are the moderately well drained Davison, Dudley, and Stickney soils around

depressions and in the flatter areas and the poorly drained Hoven soils in depressions.

About 95 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops. Conserving moisture on the Clarno soils and controlling wetness on the Tetonka soils are the main concerns of management.

This association generally is well suited to cultivated crops, to tame pasture and hay, to range, and to openland wildlife habitat and fairly well suited or well suited to rangeland wildlife habitat. It is fairly well suited or poorly suited to most kinds of building site development and most sanitary facilities.

7. Clarno-Bonilla-Ethan association

Well drained and moderately well drained, nearly level to moderately sloping, loamy soils in swales and other areas on uplands

This association is on uplands where the drainage pattern generally is well defined. Slopes are short and convex. They are steeper along drainageways than in other areas. Many swales are in the less sloping areas.

This association makes up about 33 percent of the county. It is about 40 percent Clarno and similar soils, 20 percent Bonilla soils, 20 percent Ethan and similar soils, and 20 percent minor soils (fig. 3).

The well drained Clarno soils have a slope of 0 to 9 percent. Typically, the surface layer is dark gray loam. The subsoil is olive brown, light olive brown, and pale yellow, friable clay loam and loam. It is calcareous in the lower part. The underlying material is pale yellow, calcareous loam.

The moderately well drained Bonilla soils are in swales. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown and light yellowish brown, friable loam. It is calcareous in the lower part. The underlying material is pale yellow and light yellowish brown, calcareous loam.

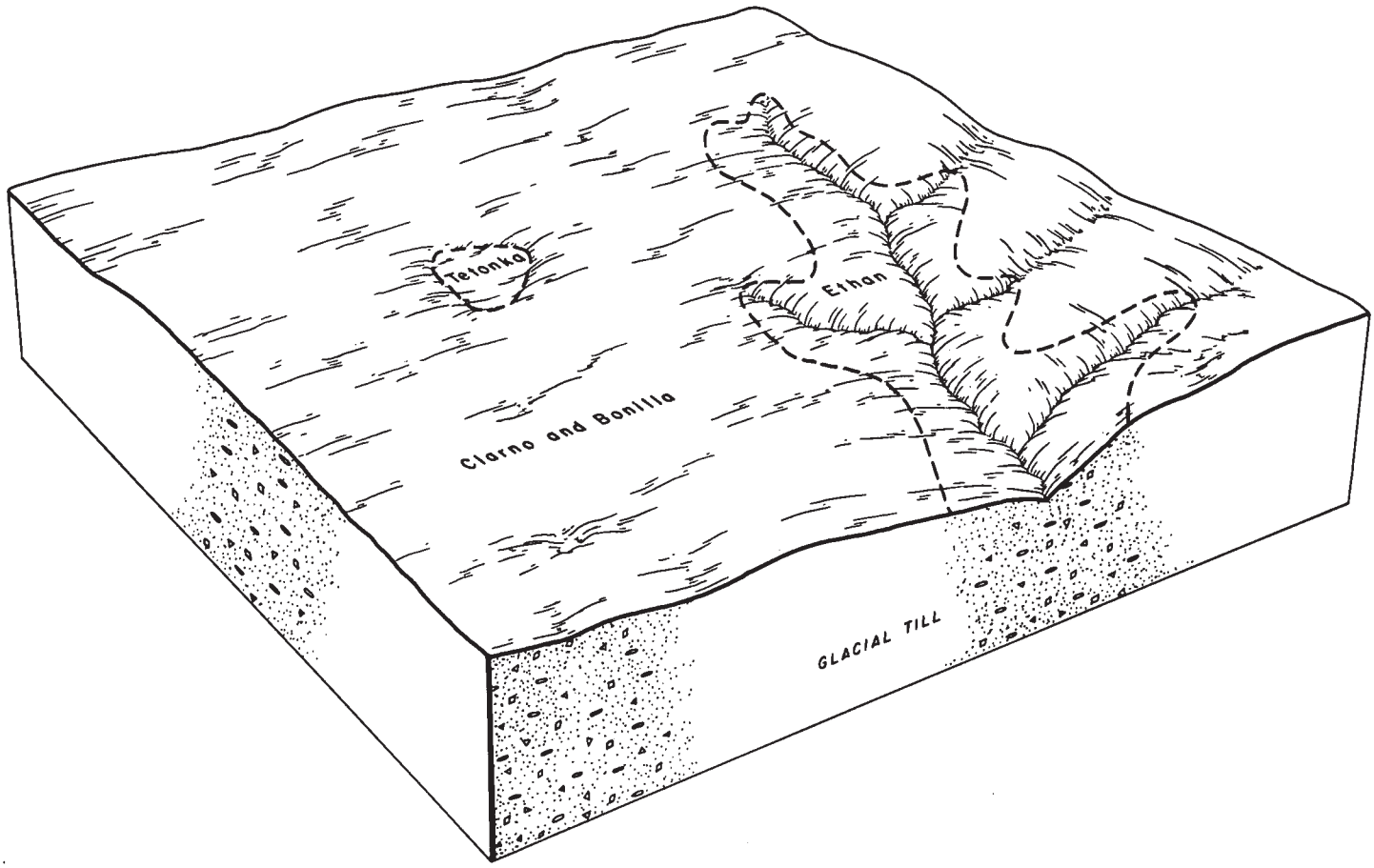

Figure 3.—Pattern of soils in the Clarno-Bonilla-Ethan association.

The well drained Ethan soils are on knolls and along the steeper drainageways. In this association they have a slope of 2 to 9 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown and light brownish gray, friable, calcareous loam and clay loam. The underlying material is light yellowish brown, calcareous clay loam.

Minor in this association are the moderately well drained Carthage, Davison, and Stickney soils; the somewhat poorly drained Dudley soils; and the poorly drained Durrstein, Hoven, Tetonka, and Worthing soils. The Carthage soils occur as areas intermingled with areas of the Clarno soils. The Davison, Stickney, and Dudley soils are in the flatter areas adjacent to depressions and swales. The nearly level Durrstein soils are in drainageways. The Hoven, Tetonka, and Worthing soils are in depressions.

About 70 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops. Some areas along the steeper drainageways are used as range. Controlling erosion and conserving moisture are the main concerns of management.

This association generally is well suited to cultivated crops and to tame pasture and hay, range, and rangeland and openland wildlife habitat. It is poorly suited to septic tank absorption fields. The Clarno and Ethan soils are well suited to fairly well suited and the Bonilla soils poorly suited to most kinds of building site development.

8. Hand-Ethan-Tetonka association

Well drained and poorly drained, level to undulating, loamy and silty soils in depressions and other areas on uplands

This association is on uplands characterized by many shallow swales and depressions. The drainage pattern is poorly defined in most areas. Most slopes are short.

This association makes up about 5 percent of the county. It is about 40 percent Hand and similar soils, 10 percent Ethan soils, 10 percent Tetonka soils, and 40 percent minor soils.

The well drained Hand soils are in smooth areas at midslope and in nearly level areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is dark grayish brown, light brownish gray, and light yellowish brown, friable loam and silt loam. It is calcareous in the lower part. The upper part of the underlying material is light gray and pale olive, calcareous silt loam and loam. The lower part is multicolored, stratified loamy and sandy sediments.

The well drained Ethan soils are on ridges and along drainageways. In this association they have a slope of 2 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown and light brownish gray, friable, calcareous loam and clay loam. The underlying material is light yellowish brown, calcareous clay loam.

The poorly drained Tetonka soils are in depressions. Slopes are 0 to 1 percent. Typically, the surface layer is gray silt loam. The subsurface layer is light gray, mottled silt loam. Next is a transitional layer of light gray silt loam and dark gray silty clay. The subsoil is dark gray, gray, and light olive gray, very firm, calcareous silty clay. It is mottled in the lower part. The underlying material is light gray, mottled, calcareous clay loam.

Minor in this association are the moderately well drained Bonilla, Carthage, and Davison soils. The Bonilla and Carthage soils are in swales. The Davison soils are on the edges of some swales and depressions.

About 95 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and sorghum are the main crops. The main concerns of management are controlling erosion and conserving moisture. Wetness and flooding are concerns in managing the Tetonka soils.

This association is well suited or fairly well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. The Hand and Ethan soils are well suited or fairly well suited to building site development and to most sanitary facilities. The Tetonka soils are poorly suited to building site development and to most sanitary facilities.

9. Houdek-Prosper-Dudley association

Well drained to somewhat poorly drained, nearly level and undulating, loamy and silty soils in swales and other areas on uplands

This association is on uplands characterized by gentle rises above broad flats, by swales, and by depressions. Slopes generally are nearly level and undulating but are steeper along the entrenched drainageways. The drainage pattern is well defined along the larger drainageways but is poorly defined in other areas.

This association makes up about 16 percent of the county. It is about 35 percent Houdek soils, 25 percent Prosper soils, 20 percent Dudley soils, and 20 percent minor soils.

The well drained Houdek soils are in the higher convex areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam. It is calcareous in the lower part. The underlying material is pale yellow and light yellowish brown, calcareous clay loam.

The moderately well drained Prosper soils are in swales. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark gray and dark grayish brown, firm clay loam over light

yellowish brown, friable, calcareous clay loam. The underlying material is light gray and light brownish gray, mottled, calcareous loam and clay loam.

The moderately well drained and somewhat poorly drained Dudley soils are in the flatter areas and on foot slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray silt loam. The subsurface layer is grayish brown silt loam. The subsoil is dark gray and dark grayish brown, very firm and firm clay loam over light yellowish brown, friable silty clay loam. The underlying material is light yellowish brown, calcareous clay loam.

Minor in this association are the well drained Ethan soils; the moderately well drained Davison and Stickney soils; the somewhat poorly drained Jerauld soils; and the poorly drained Durrstein, Hoven, Tetonka, and Worthing soils. The Ethan soils are on ridges and on the upper sides of drainageways. The nearly level Davison, Jerauld, and Stickney soils are near swales. The nearly level Durrstein soils are in drainageways. The Hoven, Tetonka, and Worthing soils are in depressions.

About 70 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, and small grain are the main crops. The main concerns of management are conserving moisture and improving tilth and fertility in all of the major soils and increasing the water intake rate in the Dudley soils. In some years wetness delays planting and harvesting in areas of the Prosper soils.

The Houdek and Prosper soils are well suited to cultivated crops and to tame pasture and hay, range, and rangeland and openland wildlife habitat. The Dudley soils are fairly well suited or poorly suited to those uses. The Prosper soils are poorly suited and the Houdek and Dudley soils fairly well suited to building site development. All of the soils are poorly suited to septic tank absorption fields.

well drained and poorly drained, strongly sloping to steep and nearly level soils

These soils are steep on valley sides and nearly level on flood plains along the James River. They are loamy and clayey.

These soils make up about 4 percent of the county. About 90 percent of the acreage is range. Some areas on the flood plains are used as cropland.

10. Betts-Clamo association

Well drained, strongly sloping to steep, loamy soils on uplands and poorly drained, nearly level, clayey soils on flood plains

This association is on the valley sides and flood plains along the James River. Slopes on the valley sides generally are strongly sloping to steep, are short and convex, and are dissected by drainageways. Glacial stones and boulders are on the surface in some areas. The smooth areas of nearly level soils on the flood plains are broken by the river channel and meander scars. They are flooded for short periods during snowmelt and after heavy rains.

This association makes up about 4 percent of the county. It is about 35 percent Betts and similar soils, 25 percent Clamo soils, and 40 percent minor soils (fig. 2).

The well drained Betts soils are on convex valley sides. Slopes range from 9 to 40 percent. Typically, the soil is calcareous loam throughout. The surface layer is dark gray. The next layer is light brownish gray. The underlying material is light brownish gray, light yellowish brown, and pale yellow.

The poorly drained Clamo soils are on flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray silty clay. The subsoil is dark gray and gray, very firm silty clay. It is calcareous in the lower part. The underlying material is dark gray and light gray, mottled, calcareous silty clay and silty clay loam.

Minor in this association are the well drained Clarno soils on the less sloping valley sides; the well drained Davis soils on colluvial foot slopes; and the somewhat poorly drained Lamo and Wann and poorly drained Durrstein and James soils on flood plains.

About 95 percent of this association is range. All of the cropland is on the flood plains. The main concerns of management are erosion on the steeper soils in the uplands and flooding on the soils on flood plains.

This association is fairly well suited to rangeland wildlife habitat. The Betts soils are poorly suited to cultivated crops and to tame pasture and hay. They are fairly well suited to range. The Clamo soils are fairly well suited to cultivated crops and to tame pasture and hay and are well suited to range. The Betts soils are poorly suited to building site development and sanitary facilities because of the slope, and the Clamo soils are poorly suited because of the flooding.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and identifies the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Clarno loam, 0 to 2 percent slopes, is one of several phases in the Clarno series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Elsmere-Orwet complex is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimiliar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

The names of some of the map units delineated on the detailed soil maps do not fully agree with those delineated on the maps in the published surveys of adjacent Beadle, Davison, Hanson, and Jerauld Counties. Differences are the result of variations in the design and composition of map units or changes in the application of the soil classification system.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

AaA—Alwilda fine sandy loam, 0 to 2 percent slopes. This somewhat excessively drained, nearly level soil is on uplands. It is moderately deep over gravelly sand. Areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is very dark gray fine sandy loam about 12 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown and grayish brown, very friable fine sandy loam and loamy fine sand. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. The surface layer is loam or loamy fine sand in places. A seasonal water table is in the lower part of the profile in some areas.

Included with this soil in mapping are small areas of the somewhat poorly drained Elsmere soils, the poorly drained Fedora and Tetonka Variant soils, and the moderately well drained Woonsocket soils. These soils make up less than 10 percent of any one mapped area. They are on the lower parts of the landscape.

The Alwilda soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is moderately rapid in the subsoil and rapid in the underlying material. Runoff is slow.

Most areas are used for cultivated crops. Melons, squash, and pumpkins are grown in some areas. A few areas support native grass and are used for grazing and hay. This soil is suited to small grain, grain sorghum, and

melons. It is droughty, however, and soil blowing is a severe hazard. Controlling soil blowing and conserving moisture are the main concerns of management. Stripcropping, crop residue management, and minimum tillage help to control soil blowing. The soil is suitable for irrigation.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

This soil is suited to windbreaks and environmental plantings. Optimum survival and growth rates are unlikely, however, because of the droughtiness.

This soil is well suited to range. The natural plant cover mainly is bluestems, needlegrasses, and prairie sandreed. Grama grasses and sedges are less extensive. Overused areas are dominated by prairie sandreed, western wheatgrass, and grama grasses.

This soil is well suited to building site development, but the sides of shallow excavations can cave in unless they are shored. Septic tank absorption fields function well in this soil, but the effluent from all sanitary facilities can pollute shallow ground water. Sand and gravel is mined in some areas for use as construction material. The quality is poor, however, because of excessive amounts of fine textured material.

The capability subclass is IIIe; Sandy range site.

AaB—Alwilda fine sandy loam, 2 to 6 percent slopes. This somewhat excessively drained, gently sloping soil is on convex ridgetops, knolls, and short, uneven side slopes in the uplands. It is moderately deep over gravelly sand. Areas are irregularly shaped and range from 5 to 250 acres in size.

Typically, the surface layer is very dark gray fine sandy loam about 12 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown and grayish brown, very friable fine sandy loam and loamy fine sand. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the surface layer is loamy fine sand or loam. In some areas the underlying material is fine sand or loamy fine sand.

Included with this soil in mapping are small areas of the poorly drained Fedora soils and the moderately well drained Woonsocket soils. These soils make up less than 5 percent of any one mapped area. They are in shallow depressions and drainageways.

The Alwilda soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is moderately rapid in the subsoil and rapid in the underlying material.

Most areas are used for tame pasture or hay. This soil is droughty, and soil blowing is a severe hazard. A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

This soil is better suited to small grain and grain sorghum than to corn. Small grain and grain sorghum are grown in some areas. Melons, squash, and pumpkins are grown in a few areas. Controlling soil blowing and conserving moisture are the main concerns in managing cultivated areas. Stripcropping, crop residue management, and minimum tillage help to control soil blowing. The soil is suitable for irrigation.

This soil is suited to windbreaks and environmental plantings. Optimum survival and growth rates are unlikely, however, because of the droughtiness.

This soil is well suited to range. The natural plant cover mainly is bluestems, needlegrasses, and prairie sandreed. Grama grasses and sedges are less extensive. Overused areas are dominated by prairie sandreed, western wheatgrass, and grama grasses.

This soil is well suited to building site development, but the sides of shallow excavations can cave in unless they are shored. Septic tank absorption fields function well in this soil, but the effluent from all sanitary facilities can pollute shallow ground water. Sand and gravel is mined in some areas for use as construction material. The quality is poor, however, because of excessive amounts of fine textured material.

The capability subclass is IIIe; Sandy range site.

Ab—Artesian-Farmsworth complex. These deep, moderately well drained and somewhat poorly drained, nearly level soils are in broad, low lying areas on uplands. The surface is uneven; many low mounds are interspersed among shallow depressions and swales. The Artesian soil is on the low mounds. The Farmsworth soil is in the shallow swales and depressions. It is subject to rare flooding. Areas are irregularly shaped and are as much as several hundred acres in size. They are 40 to 60 percent Artesian soil and 30 to 40 percent Farmsworth soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Artesian soil has a surface layer of dark gray silty clay about 7 inches thick. The subsoil is very dark gray, dark gray, and gray, very firm, calcareous clay about 25 inches thick. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay. In places layers of sand or gravelly sand are between depths of 40 and 60 inches.

Typically, the Farmsworth soil has a surface layer of dark gray loam about 4 inches thick. The subsurface layer is gray clay loam about 2 inches thick. The subsoil is a dense claypan about 22 inches thick. It is dark gray, very firm clay in the upper part and gray, mottled, calcareous clay in the lower part. It has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, light gray, and light brownish gray, mottled, calcareous clay and sandy clay loam. In places thin layers of sand, silt loam, loam, and clay are between depths of 40 and 60 inches.

Included with these soils in mapping are small areas of Durrstein, Whitelake, and Woonsocket soils. These included soils make up less than 10 percent of any one

mapped area. The poorly drained Durrstein soils are on the lowest parts of the landscape. The Whitelake and Woonsocket soils are on the higher parts of the landscape. They contain more sand and less clay in the subsoil than the Artesian and Farmsworth soils.

The Artesian soil is high in fertility and in content of organic matter. The Farmsworth soil is medium in fertility and moderate in content of organic matter. It contains enough sodium to interfere with the growth of most crops. Available water capacity is moderate in both soils. Permeability is slow or very slow. Runoff generally is slow, but the Farmsworth soil is ponded in some areas. The seasonal high water table is at a depth of 3 to 6 feet in both soils. The shrink-swell potential is very high in the Artesian soil and high in the Farmsworth soil. Cracks as much as 2 inches wide and several feet long form when the Artesian soil dries (fig. 4).

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. These soils are suited to cultivated crops. The Artesian soil is better suited than the Farmsworth soil, which has a claypan subsoil. As a result, crop growth is uneven. Early maturing crops, such as small grain, and drought-resistant crops, such as sorghum, are better suited than corn. Improving tilth, increasing the rate of water intake, and conserving moisture are the main concerns of management. Crop residue management and minimum tillage conserve moisture and improve tilth. Deep tillage helps to break up the dense claypan in the Farmsworth soil and thus increases the rate of water intake. The wetness caused by flooding and by the seasonal high water table delays fieldwork in some years. Surface drains help to remove excess water after heavy rains.

These soils are suited to tame pasture and hay. Both are suited to alfalfa and intermediate wheatgrass. Also, the Artesian soil is suited to smooth bromegrass and the Farmsworth soil to crested wheatgrass. The surface soil compacts and the grass stands deteriorate if the pasture is grazed when wet. Deferred grazing during wet periods helps to prevent puddling.

These soils are suited to range. The natural plant cover mainly is big bluestem, western wheatgrass, green needlegrass, switchgrass, and blue grama. Overused areas are dominated by blue grama and buffalograss. Restricted grazing during wet periods helps to keep the range in good condition.

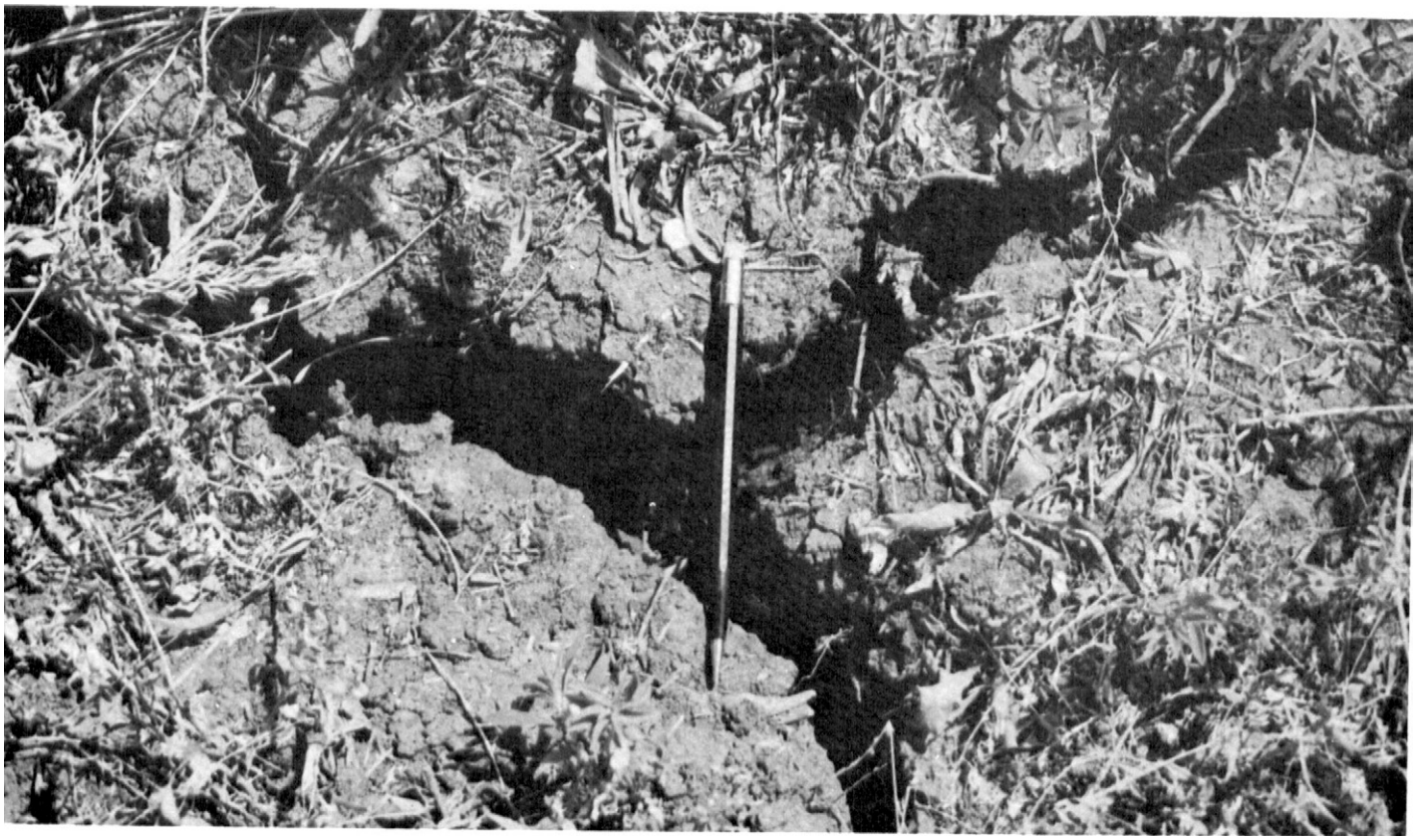

Figure 4.—Cracks in the Artesian soil in an area of Artesian-Farmsworth complex.

Windbreaks and environmental plantings can be established on these soils. Optimum survival and growth rates are unlikely, however, because of the clayey surface soil of the Artesian soil and the dense, sodium affected subsoil of the Farmsworth soil.

These soils are poorly suited to building site development because of the very high or high shrink-swell potential and the flooding. They generally are unsuitable as septic tank absorption fields because of the wetness and the restricted permeability.

The Artesian soil is in capability subclass IIs, Clayey range site; the Farmsworth soil is in capability subclass IVs, Claypan range site.

BaE—Betts loam, 15 to 40 percent slopes. This deep, well drained, moderately steep and steep soil is along entrenched drainageways. A few stones and boulders are on the surface in most areas. In some areas, however, the surface is very stony. Areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is dark gray, calcareous loam about 5 inches thick. The next 4 inches is light brownish gray, calcareous loam. The underlying material to a depth of 60 inches is light brownish gray, light yellowish brown, and pale yellow, calcareous loam. In places, the surface layer is gravelly loam and the underlying material has thin layers of gravelly sand or gravelly loam.

Included with this soil in mapping are small areas of Carthage, Clarno, Davis, Delmont, and Forestburg soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Carthage and Forestburg soils and the well drained Davis soils are on concave foot slopes and along drainageways. The well drained Clarno soils are on the lower side slopes and on steplike benches on the middle parts of the landscape. Their surface layer is thicker than that of the Betts soil. The Delmont soils are shallow to gravelly sand. They are on ridges and knolls.

The Betts soil is low in fertility and in content of organic matter. Available water capacity is high. Permeability is moderate in the upper part of the soil and moderately slow in the lower part. Runoff is rapid. The shrink-swell potential is moderate.

Most areas support native grass and are used for grazing. This soil is best suited to range. The natural plant cover dominantly is bluestems, needlegrasses, and grama grasses. Overgrazed areas are dominated by grama grasses, Kentucky bluegrass, and other less palatable range plants. Most of the draws are potential pond sites.

This soil is poorly suited to cultivated crops and to tame pasture and hay, windbreaks and environmental plantings, and most kinds of building site development and sanitary facilities because of the slope. Some climatically adapted trees and shrubs can be established for special purposes, but optimum growth and survival are unlikely.

The capability subclass is VIe; Thin Upland range site.

BbD—Betts-Ethan loams, 9 to 15 percent slopes. These deep, well drained, strongly sloping soils are along drainageways and on the breaks and valley sides along the major streams. The Betts soil is on short, convex slopes on the higher parts of the landscape. The Ethan soil generally is in areas below the Betts soil. In most areas a few stones and boulders are on the surface. In some areas, however, the surface is very stony. Areas generally are long and narrow and range from 10 to several hundred acres in size. They are 40 to 50 percent Betts soil and 30 to 40 percent Ethan soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Betts soil has a surface layer of dark gray, calcareous loam about 5 inches thick. The next 4 inches is light brownish gray, calcareous loam. The underlying material to a depth of 60 inches is light brownish gray, light yellowish brown, and pale yellow, calcareous loam. In places, the surface layer is gravelly loam and the underlying material has thin layers of gravelly sand or gravelly loam.

Typically, the Ethan soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 18 inches of dark grayish brown and light brownish gray, friable, calcareous loam and clay loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam. In places lime is leached to a depth of about 12 to 18 inches.

Included with these soils in mapping are small areas of Carthage, Davis, Delmont, and Forestburg soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Carthage and Forestburg soils and the well drained Davis soils are on foot slopes and along drainageways. The Delmont soils are shallow to gravelly sand. They are on ridges and knolls on the higher parts of the landscape. In places slopes are less than 9 percent.

The Ethan soil is medium in fertility and moderate in content of organic matter. The Betts soil is low in fertility and in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Runoff is medium or rapid. The shrink-swell potential is moderate.

Most areas support native grass and are used for grazing. These soils are best suited to range. The natural plant cover on the Betts soil dominantly is little bluestem, sideoats grama, needleandthread, and blue grama. Overgrazed areas are dominated by needleandthread and sideoats grama. The natural plant cover on the Ethan soil is bluestems, green needlegrass, sideoats grama, and western wheatgrass. Overused areas are dominated by western wheatgrass and needleandthread. Range seeding helps to restore the plant cover in areas where the range condition is poor or the surface is bare. Many areas are potential sites for excavated ponds.

These soils generally are too steep for cultivated crops and for windbreaks and environmental plantings. They can be used for tame pasture and hay, but forage production is limited by the medium or low fertility, a high content of lime, and a severe erosion hazard. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A few areas are too stony for the safe operation of farm machinery. Measures that control erosion are needed before the pasture is established.

The shrink-swell potential and the slope are limitations if these soils are used for building site development. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The restricted permeability and the slope are limitations if these soils are used as sites for sanitary facilities. These facilities should be installed in the lower areas where slopes are not so steep. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Land shaping and installation of distribution lines across the slope generally are necessary before the absorption field can function properly.

The capability subclass is VIe; the Betts soil is in Thin Upland range site, the Ethan soil in Silty range site.

BcA—Blendon fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 5 to 300 acres in size.

Typically, the surface layer is dark gray fine sandy loam about 10 inches thick. The subsoil is dark grayish brown, friable and dark brown, very friable fine sandy loam about 24 inches thick. The underlying material to a depth of 60 inches is brown loamy fine sand. In places carbonates are at a depth of 15 to 30 inches. In some areas the underlying material has layers of gravelly sand or is loam or silt loam between depths of 20 and 40 inches. The subsoil is loamy fine sand in places. On some of the lower parts of the landscape, a seasonal high water table is at a depth of 4 to 6 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Elsmere soils, the poorly drained Fedora and Tetonka Variant soils, and the moderately well drained Woonsocket soils. These soils make up less than 15 percent of any one mapped area. They are in depressions and swales.

The Blendon soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is moderately rapid in the subsoil and rapid or moderately rapid in the underlying material. Runoff is slow.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Melons, squash, and pumpkins are grown in some areas. Controlling soil blowing and conserving moisture are the main concerns of management. Stripcropping, field windbreaks, crop residue management, winter cover crops, and minimum tillage help to control soil blowing and conserve moisture. Plowing in the spring instead of the fall also reduces soil losses. Including grasses and legumes in the cropping system and planting green manure crops improve fertility and tilth. The soil is suitable for irrigation.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama. A good plant cover and ground mulch help to prevent excessive soil losses.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted trees and shrubs can grow well. A mulch of crop residue helps to control soil blowing before the windbreak is established.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations can cave in unless they are shored. Septic tank absorption fields function well, but the effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is IIIe; Sandy range site.

BcB—Blendon fine sandy loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are mostly long and narrow and range from 5 to 100 acres in size. Slopes are short and are smooth or concave.

Typically, the surface layer is dark gray fine sandy loam about 10 inches thick. The subsoil is dark gray and dark grayish brown, friable fine sandy loam about 20 inches thick. The underlying material to a depth of 60 inches is grayish brown sandy loam and loamy sand. In places the subsoil is loamy fine sand. The underlying material is stratified with loam, silt loam, or gravelly sand in some areas. On some of the lower side slopes, the soil is moderately well drained.

Included with this soil in mapping are small areas of Ethan, Fedora, and Woonsocket soils. These soils make up less than 10 percent of any one mapped area. The Ethan soils are on some of the convex ridges. They contain less sand in the subsoil than the Blendon soil. The poorly drained Fedora and moderately well drained Woonsocket soils are in depressions and drainageways.

The Blendon soil is medium in fertility and moderate in content of organic matter. Available water capacity is

moderate. Permeability is moderately rapid in the subsoil and rapid or moderately rapid in the underlying material. Runoff is slow.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is suited to corn, sorghum, alfalfa, and small grain. Melons, squash, and pumpkins are grown in some areas. Controlling soil blowing and erosion and conserving moisture are the main concerns of management. Stripcropping, crop residue management, field windbreaks, and minimum tillage help to control soil blowing and erosion and conserve moisture. The soil is suitable for irrigation.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, crested wheatgrass intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted trees and shrubs can grow well. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations can cave in unless they are shored. Septic tank absorption fields function well, but the effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is IIIe; Sandy range site.

Bd—Bon loam, channeled. This deep, moderately well drained, nearly level soil is on flood plains. It is frequently flooded for brief periods. Areas are dissected into small tracts by deep, meandering stream channels. They are long and narrow and range from 20 to 200 acres in size.

Typically, the surface layer is very dark gray loam about 6 inches thick. The subsurface layer is dark grayish brown and grayish brown, calcareous loam about 26 inches thick. The underlying material to a depth of 60 inches is light gray and grayish brown, mottled, calcareous loam and fine sandy loam. In places the surface layer has spots and threads of salts. It is silty clay loam, sandy loam, or loamy sand in some areas. On the higher parts of the landscape, the subsoil is about 20 to 30 inches thick and lime is leached to a depth of more than 36 inches. On some of the lower parts of the landscape, a seasonal high water table is at a depth of 2 to 6 feet.

The Bon soil is high in fertility and in content of organic matter. Available water capacity is high. Permeability is moderate. Runoff is slow.

Most areas support native grass and are used for grazing. This soil is well suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of western wheatgrass. Overused areas are dominated by western wheatgrass and Kentucky bluegrass.

Areas that are accessible to farm machinery can be used for tame pasture and hay. This soil is suited to alfalfa, intermediate wheatgrass, and smooth bromegrass. In some years silt and other debris left by floodwater can damage pasture plants and somewhat hinder haying.

Because of the flooding and the poor accessibility to farm machinery, this soil is poorly suited to cultivated crops. It occurs as narrow areas that are dissected into small tracts by meandering stream channels and that commonly are surrounded by moderately steep or steep side slopes. As a result, access to the areas is difficult.

This soil is poorly suited to windbreaks. The meandering stream channels dissect the areas into such small parcels that planting windbreaks is impractical. Selected trees and shrubs can be planted to enhance wildlife habitat and other areas. Wooded areas protected from grazing and other disturbances can provide excellent habitat for wildlife.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding.

The capability subclass is VIw; Overflow range site.

CaA—Carthage fine sandy loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 16 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 11 inches thick. The upper part of the underlying material is light olive brown, mottled loamy fine sand. The lower part to a depth of 60 inches is pale olive, mottled, calcareous loam stratified with thin layers of silt loam and sandy loam. In some areas the underlying material is loamy fine sand or fine sand to a depth of 60 inches or more. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Fedora, Hand, Tetonka Variant, and Woonsocket soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Fedora and Tetonka Variant soils are in depressions. The Hand soils are on the higher parts of the landscape. They contain less sand in the subsoil than the Carthage soil. The Woonsocket soils are on the slightly lower parts of the landscape. They contain more clay in the subsoil than the Carthage soil.

The Carthage soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate or high. Permeability is moderately rapid in the subsoil and moderately slow in the underlying material. A seasonal high water table is at a depth of 2.5 to 4 feet in the spring and during other wet periods. Runoff is slow. The shrink-swell potential is moderate in the underlying material.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Melons, squash, and pumpkins are grown in places. Controlling soil blowing and conserving moisture are the main concerns of management. Selection of close-sown crops, such as small grain, instead of row crops, crop residue management, minimum tillage, stripcropping, and field windbreaks help to control soil blowing, conserve moisture, and improve fertility.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted trees and shrubs can grow well. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established.

This soil is well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

This soil is well suited to development for buildings without basements and for small commercial buildings. Wetness and the shrink-swell potential are limitations, however, on sites for buildings with basements. Reinforcing the foundations and footings of buildings with basements helps to prevent the structural damage caused by shrinking and swelling. Providing drainage around the footings and foundations helps to prevent seepage into basements.

The wetness and the restricted permeability are limitations if this soil is used as a site for sanitary facilities. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Installing drainage systems that lower the seasonal high water table improves the efficiency of the septic tank absorption system. The effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is IIIe; Sandy range site.

CaB—Carthage fine sandy loam, 2 to 6 percent slopes. This deep, moderately well drained, undulating soil is on smooth or concave side slopes in the uplands. Areas mainly are long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 16 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 11 inches thick. The upper part of the underlying material is light olive brown, mottled loamy fine sand. The lower part to a depth of 60 inches is pale olive, mottled, calcareous loam stratified with thin layers of silt loam and sandy loam. In places the underlying material is loamy fine sand or fine sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Ethan, Fedora, Hand, and Woonsocket soils. These soils make up 5 to 10 percent of any one mapped area. The well drained Ethan and Hand soils are in convex areas on the higher parts of the landscape. They contain more clay in the subsoil than the Carthage soil. The poorly drained Fedora soils are in depressions and drainageways. The Woonsocket soils are on the lower parts of the landscape. They contain more clay in the subsoil than the Carthage soil.

The Carthage soil is high in fertility and in content of organic matter. Available water capacity is moderate or high. Permeability is moderately rapid in the subsoil and moderately slow in the underlying material. A seasonal high water table is at a depth of 2.5 to 4 feet in the spring and during other wet periods. Runoff is slow. The shrink-swell potential is moderate in the underlying material.

Most areas are used as cropland. This soil is suited to all of the crops commonly grown in the county. Corn, small grain, grain sorghum, and alfalfa are the main crops. Melons, squash, and pumpkins are grown in places. Controlling erosion and soil blowing is the main concern of management. Conserving moisture and improving fertility are other concerns. Crop residue management, minimum tillage, contour farming, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility. Stripcropping and field windbreaks also help to control soil blowing.

A cover of tame pasture plants or hay is effective in controlling erosion and soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted trees and shrubs can grow well. Planting the trees and shrubs on the contour and using crop residue as a mulch help to control erosion and soil blowing before the windbreak is established.

This soil is well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

This soil is well suited to development for buildings without basements. Land shaping is needed, however, on some sites for small commercial buildings, and wetness and the shrink-swell potential are limitations on sites for buildings with basements. Backfilling with sandy material and reinforcing the foundations and footings of buildings with basements help to prevent the structural damage caused by shrinking and swelling. Providing drainage around the footings and foundations helps to prevent seepage into basements.

The wetness and the restricted permeability are limitations if this soil is used as a site for sanitary facilities. Enlarging the absorption area in septic tank

absorption fields helps to overcome the slow absorption of liquid waste. Installing drainage systems that lower the seasonal high water table improves the efficiency of the septic tank absorption system. The effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is IIIe; Sandy range site.

CbA—Carthage-Clarno fine sandy loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The moderately well drained Carthage soil is in concave areas, and the well drained Clarno soil is on slight rises. Areas are irregularly shaped and are as much as several hundred acres in size. They are 40 to 50 percent Carthage soil and 30 to 40 percent Clarno soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Carthage soil has a surface layer of dark grayish brown fine sandy loam about 15 inches thick. The subsoil is dark brown, friable sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous loam and clay loam. In places the clay loam is at a depth of 10 to 20 inches.

Typically, the Clarno soil has a surface layer of dark grayish brown fine sandy loam about 7 inches thick. The subsoil is dark brown, brown, and light yellowish brown, friable loam about 21 inches thick. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous loam. The subsoil is sandy clay loam in places.

Included with these soils in mapping are small areas of Prosper, Shue, and Tetonka soils. These included soils make up 10 to 20 percent of any one mapped area. The Prosper soils are in shallow swales. They contain more clay in the subsoil than the Carthage soil and are dark to a greater depth than the Clarno soil. The somewhat poorly drained Shue and poorly drained Tetonka soils are in depressions.

The Carthage and Clarno soils are medium in fertility and moderate in content of organic matter. Tilth is good in both soils. Available water capacity is moderate or high. Permeability is moderately rapid in the subsoil of the Carthage soil and moderate in the subsoil of the Clarno soil. It is moderately slow in the underlying material of both soils. The Carthage soil has a seasonal high water table at a depth of 2.5 to 4 feet in wet years. Runoff is slow on both soils. The shrink-swell potential is moderate in the underlying material.

Most areas are used as cropland. These soils commonly are used for corn, sorghum, and small grain. Melons, squash, and pumpkins also are grown. The main concerns of management are controlling soil blowing and conserving moisture. Selecting close-sown crops, such as small grain, instead of row crops, stripcropping, managing crop residue, planting field windbreaks, keeping tillage to a minimum, and plowing in the spring instead of the fall help to control soil blowing and conserve moisture.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. Planting cover crops and using crop residue as a mulch help to control soil blowing before the windbreaks are established.

These soils are well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

The shrink-swell potential is a limitation if these soils are used as sites for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Wetness is an additional limitation if the Carthage soil is used as a site for dwellings with basements. Providing drainage around footings and foundations helps to prevent seepage into basements.

The restricted permeability is a limitation if these soils are used as sites for sanitary facilities. The wetness of the Carthage soil is also a limitation. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Installing drainage systems that lower the seasonal high water table in the Carthage soil improves the efficiency of the septic tank absorption system.

The capability subclass is IIIe; Sandy range site.

CcB—Carthage-Hand fine sandy loams, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The moderately well drained Carthage soil is on the smooth and concave lower side slopes and in swales. The well drained Hand soil is on convex ridgetops and the upper side slopes. Areas are irregularly shaped and are as much as several hundred acres in size. They are about 40 to 60 percent Carthage soil and 20 to 40 percent Hand soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Carthage soil has a surface layer of dark grayish brown fine sandy loam about 15 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 7 inches thick. The upper part of the underlying material is light olive brown, mottled loamy fine sand. The lower part to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. The surface layer is loamy fine sand in places. In some areas the underlying material is silt loam, very fine sandy loam, loamy fine sand, or fine sand.

Typically, the Hand soil has a surface layer of dark grayish brown fine sandy loam about 9 inches thick. The subsoil is light yellowish brown loam about 16 inches thick. The underlying material to a depth of 60 inches is calcareous, stratified loamy sediments. In places the

surface layer is less than 9 inches thick and contains lime. In some areas the subsoil is clay loam.

Included with these soils in mapping are small areas of Fedora, Shue, Tetonka, and Woonsocket soils. These included soils make up less than 20 percent of any one mapped area. The poorly drained Fedora and Tetonka soils and the somewhat poorly drained Shue soils are in depressions. The Woonsocket soils are in swales. They are underlain by loamy fine sand or fine sand.

The Carthage and Hand soils are medium in fertility and moderate in content of organic matter. Available water capacity is moderate or high in the Carthage soil and high in the Hand soil. Permeability is moderately rapid in the subsoil of the Carthage soil and moderately slow in the underlying material. It is moderate in the Hand soil. The Carthage soil has a seasonal high water table at a depth of 2.5 to 4 feet in the spring and during other wet periods. Runoff is slow on both soils.

Most areas are used as cropland. These soils are suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Melons, squash, and pumpkins are grown in some areas. The main concern of management is controlling erosion and soil blowing. Conserving moisture and increasing the content of organic matter are other concerns. Stripcropping, contour farming, grassed waterways, crop residue management, minimum tillage, and field windbreaks help to control erosion and soil blowing, conserve moisture, and improve fertility.

A cover of tame pasture plants or hay is effective in controlling erosion and soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted trees and shrubs grow well. Planting the trees and shrubs on the contour helps to control erosion. A mulch of crop residue helps to control soil blowing before the windbreak is established.

These soils are well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

The shrink-swell potential is a limitation if these soils are used as sites for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Wetness is an additional limitation if the Carthage soil is used as a site for dwellings with basements. Providing drainage around footings and foundations helps to prevent seepage into basements.

The restricted permeability is a limitation if these soils are used as sites for sanitary facilities. The wetness of the Carthage soil is also a limitation. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Installing drainage systems that lower the seasonal high water table in the Carthage soil improves the efficiency of the septic tank absorption system.

The capability subclass is IIIe; Sandy range site.

Cd—Clamo loam. This deep, poorly drained, nearly level soil is on flood plains. It is occasionally flooded. Meandering stream channels dissect some areas into small tracts. Areas are long and narrow and range from 10 to 80 acres in size.

Typically, the surface layer is dark gray loam about 6 inches thick. The subsoil is dark gray, firm silty clay about 17 inches thick. It has spots and threads of carbonates in the lower part. The underlying material to a depth of 60 inches is dark gray and light gray, mottled, calcareous silty clay and silty clay loam. The surface layer is fine sandy loam in some areas, and in other areas it has carbonates. In places the subsoil is clay loam. The underlying material is fine sand in some areas.

Included with this soil in mapping are small areas of Blendon, Durrstein, and Wann soils. These soils make up less than 15 percent of any one mapped area. The well drained Blendon soils are in the higher lying areas. They contain more sand and less clay throughout than the Clamo soil. The Durrstein soils are in the concave low lying areas. They contain more salts than the Clamo soil. The Wann soils are along the stream channels. They contain more sand throughout than the Clamo soil.

The Clamo soil is high in fertility and in content of organic matter. Available water capacity is high. Permeability is slow. A seasonal high water table is within a depth of 3 feet. Runoff is very slow. The shrink-swell potential is high in the subsoil.

Most areas support native grass and are used for grazing. A few areas adjacent to large areas of cropland or tame pasture are cultivated or pastured. This soil is well suited to range. The natural plant cover dominantly is big bluestem, switchgrass, indiangrass, and sedges. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. Wetness is the major concern of management. A planned grazing system that includes restricted use during the wet periods helps to keep the range in good condition.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass grow well. Deferment of grazing or haying during wet periods helps to prevent compaction of the soil and deterioration of the plant community.

This soil is well suited to windbreaks and environmental plantings. The trees and shrubs that require an abundant moisture supply are especially well suited.

Most areas are not used as cropland because farm machinery cannot cross the meandering stream channels. Some of the larger areas, however, are well suited to cultivated crops, especially to late-planted

crops, such as corn and sorghum. Surface drainage is adequate for intensive cropping in most areas. The wetness caused by flooding and by the seasonal high water table, however, delays fieldwork in some years. If outlets are available, underground drains can be used to lower the water table. Flood damage can be reduced by constructing dikes and diversions. The surface compacts and tilth deteriorates if the soil is tilled when wet. Crop residue management, minimum tillage, and timely tillage improve tilth and increase the water intake rate.

This soil is unsuitable as a site for buildings and sanitary facilities because of the flooding.

The capability subclass is IIw; Subirrigated range site.

Ce—Clamo silty clay. This deep, poorly drained, nearly level soil is on flood plains. It is occasionally flooded. Areas mainly are long and narrow and range from 5 to several hundred acres in size.

Typically, the surface layer is dark gray silty clay about 8 inches thick. The subsoil is dark gray and gray, very firm silty clay about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is dark gray and light gray, mottled, calcareous silty clay and silty clay loam. In places the surface layer is calcareous and has spots and threads of salts. In some areas the underlying material is silt loam between depths of 20 and 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Bon and somewhat poorly drained Wann soils. These soils make up less than 10 percent of any one mapped area. They are on the slightly higher parts of the landscape. They contain less clay than the Clamo soil.

The Clamo soil is high in fertility and in content of organic matter. Available water capacity is high. Permeability is slow. A seasonal high water table is within a depth of 3 feet. Runoff is very slow. The shrink-swell potential is high.

About half of the areas are used for range, and half are used for tame pasture and hay. A few areas are used as cropland. This soil is well suited to range. The natural plant cover dominantly is cordgrass. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well. Extra moisture from the seasonal high water table is available for the trees most of the year.

This soil is suited to all of the crops commonly grown in the county. Corn, small grain, grain sorghum, and alfalfa are the main crops. If the soil is cultivated when wet, it compacts and is very hard and cloddy when dry. Spring planting commonly is delayed during wet years. If outlets are available, the water table can be lowered by installing underground drains. Dikes, diversions, and floodways control floodwater and reduce the extent of flood damage. Crop residue management, minimum tillage, and timely tillage improve tilth and increase the rate of water intake.

Because of the flooding and the wetness, this soil is unsuitable as a site for buildings and sanitary facilities.

The capability subclass is IIIw; Subirrigated range site.

Cf—Clamo silty clay, frequently flooded. This deep, poorly drained, nearly level soil is on flood plains. Areas are long and narrow and range from 5 to 120 acres in size.

Typically, the surface layer is dark gray, mottled silty clay about 8 inches thick. The subsoil is dark gray and gray, mottled, very firm silty clay about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is gray, mottled, calcareous silty clay loam. In some areas sand or gravelly sand is 40 to 60 inches from the surface. In places spots and threads of salts are in the surface layer.

This soil is high in fertility and in content of organic matter. Available water capacity is high. Permeability is slow. A seasonal high water table is within a depth of 3 feet. Runoff is very slow. The shrink-swell potential is high.

About half of the areas are used for grazing, and half are used for wildlife habitat. Most areas are suited to range. The natural plant cover dominantly is prairie cordgrass. Overgrazed areas are dominated by sedges, saltgrass, and Kentucky bluegrass. Grazing when the soil is wet causes surface compaction. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition.

The natural plant cover in some areas is rushes, cattails, and other aquatic vegetation not palatable to livestock. These areas are best suited to wetland wildlife habitat. Shallow ponds can be excavated to provide open water areas for waterfowl and furbearers.

This soil is poorly suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It is unsuitable as a site for buildings and sanitary facilities because of the flooding.

The capability subclass is Vw; Wetland range site.

CgA—Clarno loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark gray loam about 6 inches thick. The subsoil is about 25 inches of olive brown, light olive brown, and pale yellow, friable clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale

yellow, calcareous loam. In places the surface layer is fine sandy loam. In some areas the underlying material has thin layers of silt loam, very fine sandy loam, and fine sand. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Prosper and Tetonka soils. These soils make up less than 10 percent of any one mapped area. The Prosper soils are in shallow swales and are moderately well drained. The Tetonka soils are in depressions and are poorly drained.

The Clarno soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate in the subsoil and moderately slow in the underlying material. Runoff is slow. The shrink-swell potential is moderate.

Most areas are used as cropland. This soil is well suited to corn, small grain, sorghum, and alfalfa. Conserving moisture and improving fertility and tilth are the main concerns of management. Crop residue management, minimum tillage, and applications of fertilizer conserve moisture and improve fertility.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass grow well.

This soil is well suited to range. The natural plant cover mainly is needlegrass, bluestems, and western wheatgrass and lesser amounts of sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, all climatically adapted trees and shrubs grow well.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

This soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste.

The capability subclass is IIc; Silty range site.

ChB—Clarno-Bonilla loams, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The well drained Clarno soil is on ridges, knolls, and the upper side slopes. The moderately well drained Bonilla soil is in swales and drainageways and on the lower side slopes. It is frequently flooded for very brief periods. In some areas of the Clarno soil, a few glacial stones are on the surface. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 40 to 50 percent Clarno soil and 20 to 30 percent Bonilla soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 25 inches of olive brown, light olive brown, and pale yellow, friable clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous loam. In places the subsoil contains more clay. In some areas the underlying material is stratified with silt loam and sand. In other areas the surface layer is calcareous.

Typically, the Bonilla soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark grayish brown and light yellowish brown, friable loam about 33 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown loam. In places the subsoil contains more clay. In some areas the underlying material is stratified with silt loam and sand.

Included with these soils in mapping are small areas of Davison, Dudley, and Tetonka soils. These included soils make up less than 25 percent of any one mapped area. The Davison soils are on the rims around depressions. They have lime in the surface layer. The Dudley soils are in positions on the landscape similar to those of the Bonilla soil. They have a dense claypan subsoil. The Tetonka soils are in depressions and are poorly drained.

The Clarno soil is medium in fertility and moderate in content of organic matter. The Bonilla soil is high in fertility and in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet. Runoff is medium on the Clarno soil and slow on the Bonilla soil. The shrink-swell potential is moderate in both soils.

Most areas are used as cropland or for tame pasture and hay. Some areas support native grass and are used for grazing. These soils are well suited to all of the crops commonly grown in the county. In cultivated areas controlling erosion and conserving moisture are the main concerns of management. Crop residue management, minimum tillage, grassed waterways, and contour farming help to control erosion, conserve moisture, and improve tilth and fertility. Planting and harvesting are delayed during wet periods in some areas of the Bonilla soil.

A cover of tame pasture plants or hay is effective in controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass grow well.

These soils are well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well if competing vegetation is controlled.

These soils are well suited to range. The natural plant cover mainly is bluestems, needlegrass, western wheatgrass, and lesser amounts of sideoats grama. Overgrazed areas are dominated by western wheatgrass and needleandthread.

The Bonilla soil is unsuitable as a site for buildings because it is subject to flooding. The Clarno soil is a

better site, but the shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area in these fields, however, helps to overcome the slow absorption of liquid waste. The Bonilla soil is not suitable as a septic tank absorption field because of the flooding and the wetness.

The capability subclass is IIe; the Clarno soil is in Silty range site, the Bonilla soil in Overflow range site.

CkB—Clarno-Dudley complex, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The well drained Clarno soil is on smooth and convex side slopes. The moderatly well drained Dudley soil is on concave side slopes and in swales and shallow depressions. A few glacial stones are on the surface in most areas. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 40 to 50 percent Clarno soil and 25 to 35 percent Dudley soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 25 inches of olive brown, light olive brown, and pale yellow, friable clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous loam. In places the subsoil contains more clay. In some areas the underlying material is stratified with silt loam and sand. In other areas the surface layer is calcareous.

Typically, the Dudley soil has a surface layer of dark gray silt loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 2 inches thick. The subsoil is about 23 inches thick. It is dark gray and dark grayish brown, very firm and firm clay loam in the upper part and light yellowish brown, friable, calcareous silty clay loam in the lower part. It has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam. In some cultivated areas the surface layer and subsurface layer are mixed with the upper part of the subsoil. In some places the surface layer is 10 to 12 inches thick. In other places accumulations of salts are 10 to 16 inches from the surface. In some areas a seasonal high water table is at a depth of about 4 feet. In other areas the underlying material is stratified with silt loam, very fine sandy loam, and silty clay loam.

Included with these soils in mapping are small areas of Davison, Hoven, Prosper, and Tetonka soils. These included soils make up less than 30 percent of any one mapped area. The Davison soils are on the rims around depressions. They contain lime in the surface layer. The Hoven and Tetonka soils are poorly drained and are in depressions. The Prosper soils are in swales and drainageways and are moderately well drained. They lack columnar structure in the subsoil. Also included are very saline slickspots or other bare areas.

The Clarno and Dudley soils are medium in fertility and moderate in content of organic matter. Available water capacity is high in the Clarno soil and moderate or high in the Dudley soil. Permeability is moderate in the upper part of the Clarno soil and moderately slow in the lower part. It is very slow in the subsoil of the Dudley soil and slow or moderately slow in the underlying material. Runoff is medium on the Clarno soil and slow on the Dudley soil. The dense claypan subsoil and the sodium salts in the Dudley soil restrict root penetration. The shrink-swell potential is high in the subsoil of the Dudley soil and moderate in the Clarno soil.

Most areas are used for tame pasture and hay and for range. A cover of tame pasture plants or hay is effective in controlling erosion. Both soils are suited to alfalfa and intermediate wheatgrass. Also, the Clarno soil is suited to smooth bromegrass and the Dudley soil to crested wheatgrass.

These soils are suited to range. The natural plant cover mainly is needlegrasses and western wheatgrass and, on the Clarno soil, lesser amounts of bluestem and sideoats grama. Overused areas are dominated by needleandthread, buffalograss, and blue grama.

Crop growth is restricted on the Dudley soil because the dense, compact subsoil restricts root penetration. As a result, early maturing crops, such as small grain, and drought-resistant crops, such as sorghum, are better suited than corn. Controlling erosion, conserving moisture, and increasing the rate of water intake are the main concerns of management. Crop residue management and minimum tillage conserve moisture and help to control erosion. Deep tillage helps to break up the dense claypan subsoil in the Dudley soil and increases the rate of water intake.

The Clarno soil is well suited to most of the trees and shrubs grown as windbreaks and environmental plantings, but the Dudley soil is poorly suited. Some trees and shrubs can be established on the Dudley soil, but optimum growth and survival are unlikely.

Because of the high shrink-swell potential, the Dudley soil provides an unstable base for buildings. The Clarno soil is a better building site, but its moderate shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling of the Clarno soil. Reinforcing foundations and footings also helps to prevent this damage.

The Dudley soil generally is unsuitable as a site for septic tank absorption fields because of very restricted permeability. The Clarno soil is poorly suited because of restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste in this soil.

The Clarno soil is in capability subclass IIe, Silty range site; the Dudley soil is in capability subclass IVs, Claypan range site.

CmB—Clarno-Ethan loams, 2 to 6 percent slopes. These deep, well drained, gently sloping and undulating soils are on uplands. The Clarno soil is on the smooth or convex lower side slopes and on the broader ridgetops. The Ethan soil is on the convex upper side slopes. A few glacial stones are on the surface in most areas. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 50 to 60 percent Clarno soil and 25 to 35 percent Ethan soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 16 inches thick. It is dark grayish brown, friable clay loam in the upper part and light brownish gray, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous loam. In some places the surface layer is fine sandy loam. In other places the subsoil contains more clay. In some areas the underlying material has layers of silt loam, very fine sandy loam, or sand.

Typically, the Ethan soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 18 inches of dark grayish brown and light brownish gray, friable, calcareous loam and clay loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam. In places it is stratified with very fine sandy loam or sand.

Included with these soils in mapping are small areas of Bonilla and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Bonilla soils are in swales and are moderately well drained. The Tetonka soils are in depressions and are poorly drained.

The Clarno and Ethan soils are medium in fertility and moderate in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Runoff is medium. The shrink-swell potential is moderate.

Most areas are used as cropland (fig. 5). A few areas support native grass and are used for grazing. These soils are well suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Erosion is the main concern of management. Improving fertility also is a concern. Crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility and tilth.

A cover of tame pasture plants or hay is effective in controlling erosion. These soils are well suited to alfalfa, smooth bromegrass, and wheatgrass.

The Clarno soil is well suited to the trees and shrubs grown as windbreaks and environmental plantings, but optimum growth is unlikely on the Ethan soil. Planting windbreaks on the contour helps to control erosion.

These soils are well suited to range. The natural plant cover mainly is needlegrasses and western wheatgrass and lesser amounts of bluestems and sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

The shrink-swell potential is a limitation if these soils are used as sites for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The restricted permeability is a limitation if these soils are used as septic tank absorption fields. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste.

The Clarno soil is in capability subclass IIe, the Ethan soil in capability subclass IIIe; both soils are in Silty range site.

CoA—Clarno-Prosper loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Clarno soil is on smooth and convex slopes on the higher parts of the landscape. The moderately well drained Prosper soil is in shallow swales. It is frequently flooded for very brief periods. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 50 to 60 percent Clarno soil and 20 to 40 percent Prosper soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 25 inches of olive brown, light olive brown, and pale yellow, friable clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous loam. It has thin layers of silt loam, very fine sandy loam, and fine sand in places. In some areas the subsoil contains more clay.

Typically, the Prosper soil has a surface layer of dark gray loam about 11 inches thick. The subsoil is about 19 inches thick. It is dark gray and dark grayish brown, firm clay loam in the upper part and light yellowish brown, friable, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is light gray and light brownish gray, mottled, calcareous loam and clay loam. The subsoil is silty clay or clay in places.

Included with these soils in mapping are small areas of Davison, Dudley, Stickney, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Davison soils occur as narrow bands around depressions. They have lime in the surface layer. The Dudley and Stickney soils are in concave areas. They contain sodium. Also, their subsoil contains more

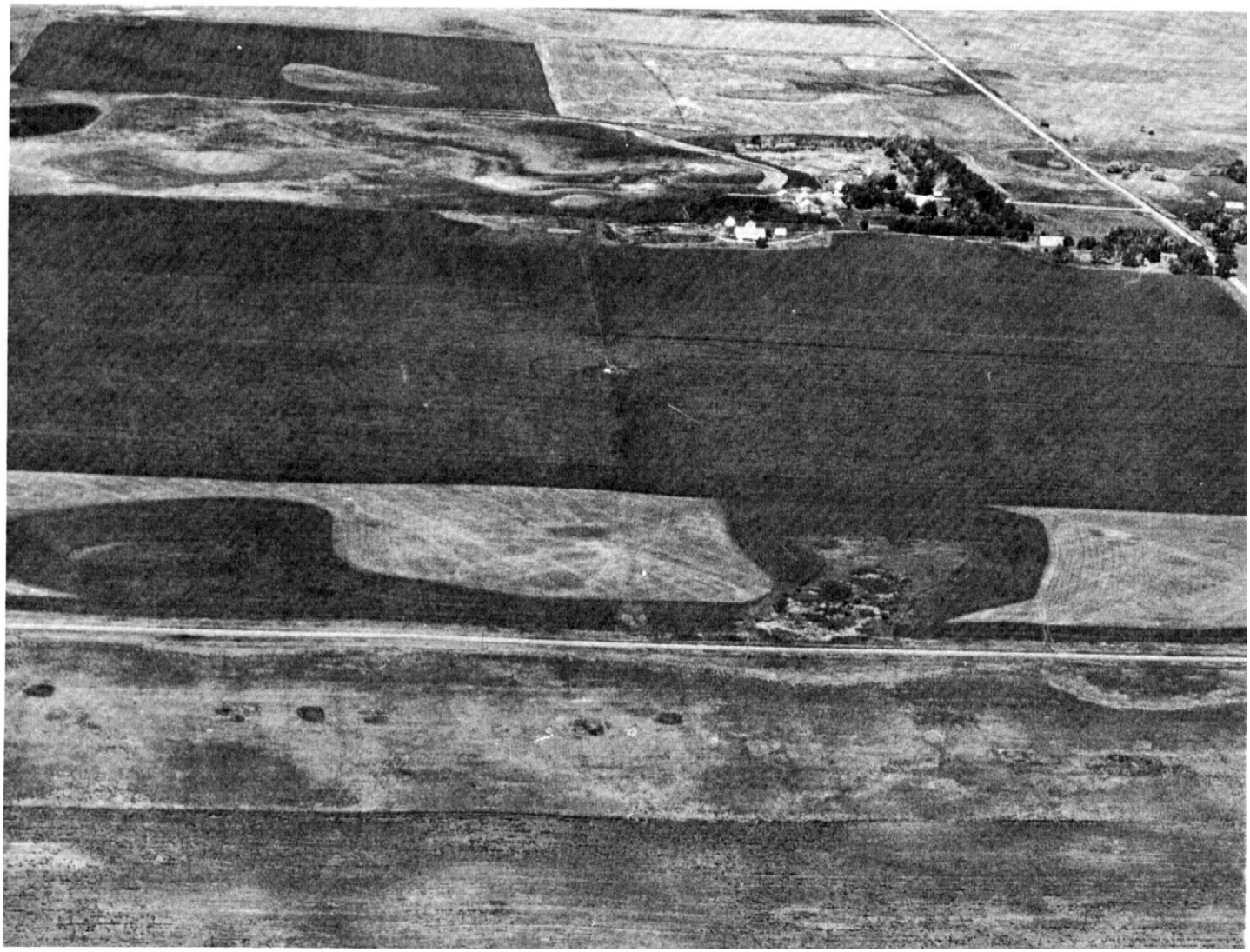

Figure 5.—A cropped area of Clarno-Ethan loams, 2 to 6 percent slopes.

clay than that of either the Clarno or Prosper soil. The Tetonka soils are in depressions and are poorly drained.

The Clarno soil is medium in fertility and moderate in content of organic matter. The Prosper soil is high in fertility and in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. The Prosper soil receives runoff from the soils higher on the landscape. It has a seasonal high water table at a depth of 3 to 6 feet. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most areas are used as cropland or for tame pasture and hay. A few areas support native grass and are used for grazing or hay. These soils are well suited to cultivated crops. Conserving moisture is the main concern of management. Improving tilth and fertility are other concerns. Crop residue management and minimum tillage conserve moisture and improve tilth and fertility. During some wet periods planting and harvesting are delayed on the Prosper soil.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

The Clarno soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well. The Prosper soil is well suited to the trees and shrubs that require an abundant moisture supply.

These soils are well suited to range. The natural plant cover mainly is needlegrasses, bluestems, and western wheatgrass and lesser amounts of sideoats grama.

Overgrazed areas are dominated by western wheatgrass, Kentucky bluegrass, and needleandthread.

Because of the flooding and the wetness, the Prosper soil generally is unsuitable as a site for buildings. The Clarno soil is a better site, but its moderate shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling of the Clarno soil. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste in this soil. The Prosper soil is not suitable as a septic tank absorption field because of the flooding and the wetness.

The capability subclass is IIc; the Clarno soil is in Silty range site, the Prosper soil in Overflow range site.

DaB—Davis loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on concave foot slopes, on alluvial fans, and on high terraces along streams. Areas are long and narrow and range from 5 to 25 acres in size.

Typically, the surface layer is dark gray loam about 10 inches thick. The subsoil is about 34 inches of dark gray, grayish brown, and brown, friable loam and clay loam. It is calcareous and mottled in the lower part. The underlying material to a depth of 60 inches is brown and pale brown, mottled, calcareous clay loam and loam. The surface layer is sandy loam in places. In some areas carbonates are in the upper part of the subsoil.

Included with this soil in mapping are small areas of Clarno and Houdek soils. These soils make up less than 10 percent of any one mapped area. They are well drained and are on the higher parts of the landscape.

The Davis soil is high in fertility and in content of organic matter. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate.

Most areas are used as range. This soil is well suited to range. The natural plant cover mainly is needlegrasses, bluestems, and western wheatgrass and lesser amounts of sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

This soil is well suited to all of the crops commonly grown in the county. Only a small acreage is used as cropland, however, because areas are long and narrow and generally are adjacent to nonarable soils. Corn, small grain, sorghum, and alfalfa are the main crops. Controlling erosion is the main concern in managing cultivated areas. Crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility and tilth.

A cover of tame pasture plants or hay is effective in controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well, especially those that require an abundant supply of moisture.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The restricted permeability is a limitation if this soil is used as a septic tank absorption field. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste.

The capability subclass is IIe; Silty range site.

Db—Davison loam. This deep, moderately well drained, nearly level soil is on the slightly convex rises adjacent to swales and depressions in the uplands. Areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark gray, calcareous loam about 8 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous loam. In places the surface layer is sandy loam. In some areas sand or gravelly sand is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Clarno, Hand, Houdek, Prosper, Shue, Tetonka, and Worthing soils. These soils make up less than 15 percent of any one mapped area. The well drained Clarno, Hand, and Houdek soils are on the higher parts of the landscape. The Prosper soils are in swales. They do not have lime in the surface layer. The somewhat poorly drained Shue, poorly drained Tetonka, and poorly drained and very poorly drained Worthing soils are in depressions.

The Davison soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate. A seasonal high water table is at a depth of 1.5 to 6.0 feet. Runoff is slow. The shrink-swell potential is moderate.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is well suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Controlling soil blowing is the main concern of management. Improving fertility also is a concern. Crop residue management and minimum tillage help to control soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass,

and smooth bromegrass are suitable. The seasonal high water table provides additional moisture to plant roots early in the growing season.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well. The seasonal high water table provides extra moisture to the trees and shrubs in the spring of most years.

This soil is well suited to range. The natural plant cover mainly is needlegrasses and bluestems and lesser amounts of western wheatgrass and sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

This soil is poorly suited to building site development and sanitary facilities because of the wetness. If buildings are constructed, reinforced foundations and footings and a subsurface drainage system help to prevent the structural damage caused by the shrinking and swelling of the soil.

The capability subclass is IIe; Limy Subirrigated range site.

Dc—Davison Variant silt loam. This deep, moderately well drained, nearly level soil is on rises adjacent to depressions in the uplands. Areas are irregular in shape and range from 5 to 150 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark gray, calcareous silt loam about 8 inches thick. The next 8 inches is light yellowish brown, calcareous silt loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam and very fine sandy loam. In places the surface layer is fine sandy loam or loamy fine sand. The underlying material is stratified loamy fine sand and loam in some areas.

Included with this soil in mapping are small areas of the somewhat poorly drained Elsmere and poorly drained Orwet and Tetonka soils. These soils make up less than 15 percent of any one mapped area. They are on the lower parts of the landscape.

The Davison Variant soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate. A seasonal high water table is at a depth of 3 to 6 feet. Runoff is slow.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is well suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Controlling soil blowing and conserving moisture are the main concerns of management. Improving fertility also is a concern. The wetness caused by the seasonal high water table delays planting in some years. Crop residue management and minimum tillage help to control soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. The seasonal high water table provides additional moisture to plant roots early in the growing season.

This soil is well suited to range. The natural plant cover mainly is needlegrasses and bluestems and lesser amounts of western wheatgrass and sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well. The seasonal high water table provides additional moisture to the trees and shrubs. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established.

This soil is poorly suited to most kinds of building site development and sanitary facilities because of the wetness. It is suitable as a site for buildings without basements, however, because the seasonal high water table is below a depth of 3 feet.

The capability subclass is IIe; Limy Subirrigated range site.

DdA—Delmont loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on stream terraces. It is shallow over gravelly sand. Areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark gray loam about 5 inches thick. The subsoil is dark grayish brown and grayish brown, friable loam about 9 inches thick. The underlying material to a depth of 60 inches is grayish brown and brown, calcareous gravelly loamy sand and gravelly sand. In some places gravelly sand is 20 to 40 inches from the surface. In other places it is within a depth of 10 inches. In some areas the surface layer and the subsoil are sandy loam or fine sandy loam.

Included with this soil in mapping are small areas of Alwilda soils. These soils make up less than 15 percent of any one mapped area. They contain more sand in the subsoil than the Delmont soil. Their position on the landscape is similar to that of the Delmont soil.

The Delmont soil is medium in fertility and moderate in content of organic matter. Available water capacity is low. Permeability is moderately rapid or moderate in the subsoil and rapid in the underlying material. Runoff is slow.

Most areas are used for tame pasture or hay. A few areas are used for cultivated crops. This soil is better suited to small grain and grasses than to late-maturing crops, such as corn, because it is droughty. Conserving moisture is the main concern in managing cultivated areas. Crop residue management and minimum tillage conserve moisture. Leaving the surface rough after fall plowing increases the moisture supply because a rough surface catches snow. Including grasses and legumes in the cropping system improves fertility and tilth.

A cover of tame pasture plants or hay is effective in conserving moisture. Crested wheatgrass and pubescent

wheatgrass are suitable. Forage production is restricted in dry years because of the low available water capacity.

This soil is poorly suited to windbreaks and environmental plantings because of the droughtiness. Only the trees and shrubs that are provided with extra moisture and are otherwise given special care can survive. Optimum growth is unlikely, however, even if the trees and shrubs are given special care.

This soil is suited to range. The natural plant cover mainly is needleandthread, grama grasses, and threadleaf sedge. Overused areas are dominated by threadleaf sedge and blue grama. After continued overuse, Kentucky bluegrass and weeds dominate the site.

This soil is well suited to most kinds of building site development and to septic tank absorption fields. The sides of shallow excavations can cave in, however, unless they are shored, and the effluent from sanitary facilities can pollute shallow ground water. The soil is a good source of sand and gravel for road surfacing.

The capability subclass is IVs; Shallow to Gravel range site.

DeA—Doger loamy fine sand, 0 to 2 percent slopes. This deep, somewhat excessively drained, nearly level soil is on uplands. Areas are irregular in shape and range from 5 to 500 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 9 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 5 inches thick. The next 9 inches is grayish brown fine sand. The underlying material to a depth of 60 inches is brown and pale brown fine sand. It is calcareous in the lower part. In places it is stratified clay loam to very fine sandy loam between depths of 30 and 60 inches. The surface layer is fine sandy loam in some areas.

Included with this soil in mapping are small areas of Elsmere and Shue soils. These soils make up less than 15 percent of any one mapped area. They are in swales and depressions and are somewhat poorly drained.

The Doger soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is rapid. Runoff is slow or very slow.

About half of the areas are used for cultivated crops, and half are used for tame pasture and hay. This soil is better suited to close-sown crops, such as small grain and alfalfa, than to row crops because of droughtiness and a very severe soil blowing hazard. Melons, squash, and pumpkins are grown in places. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing, conserve moisture, and improve fertility. Emergency tillage, which leaves the surface rough and cloddy, helps to control soil blowing until more permanent measures can be applied. Plowing in the spring instead of the fall reduces the risk of soil blowing.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

This soil is well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that require an abundant moisture supply, most of the climatically adapted species can grow well. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing.

If sites are protected from soil blowing, this soil is well suited to building site development. The sides of shallow excavations, however, can cave in unless they are shored. The soil is well suited to septic tank absorption fields, but the effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is IVe; Sandy range site.

DeB—Doger loamy fine sand, 2 to 6 percent slopes. This deep, somewhat excessively drained, gently sloping soil is on uplands. Areas are mostly long and narrow and range from 5 to 50 acres in size. Slopes are short and convex.

Typically, the surface layer is dark gray loamy fine sand about 9 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 5 inches thick. The next 9 inches is grayish brown fine sand. The underlying material to a depth of 60 inches is brown and pale brown fine sand. It is calcareous in the lower part. In places it is stratified clay loam to very fine sandy loam between depths of 20 and 60 inches. The surface layer is fine sandy loam in some areas.

Included with this soil in mapping are small areas of Elsmere and Shue soils. These soils make up less than 15 percent of any one mapped area. They are in drainageways and depressions and are somewhat poorly drained.

The Doger soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is rapid. Runoff is slow or very slow.

About half of the areas are used for cultivated crops, and half are used for tame pasture and hay. This soil is better suited to close-sown crops, such as small grain, than to row crops because of droughtiness and a very severe soil blowing hazard. Melons, squash, and pumpkins are grown in places. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing, conserve moisture, and improve fertility. Plowing in the spring instead of the fall reduces the risk of soil blowing.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

This soil is well suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that require an abundant moisture supply, most of the climatically adapted species can grow well. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing.

If sites are protected from soil blowing, this soil is well suited to building site development. The sides of shallow excavations, however, can cave in unless they are shored. The soil is well suited to septic tank absorption fields, but the effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is IVe; Sandy range site.

DfA—Dudley-Jerauld-Clarno complex, 0 to 2 percent slopes. These nearly level soils are on uplands. The somewhat poorly drained Dudley soil is in intermediate positions on the landscape between the Jerauld and Clarno soils. The somewhat poorly drained Jerauld soil is in small depressions, and the well drained Clarno soil is on the slightly higher, convex parts of the landscape. The surface is uneven; many slight rises are interspersed between the small, shallow depressions. In most areas a few stones and boulders are on the surface. Areas are irregular in shape and range from 5 to 200 acres in size. They are 30 to 40 percent Dudley soil, 20 to 30 percent Jerauld soil, and 15 to 25 percent Clarno soil. The three soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Dudley soil has a surface layer of dark gray silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is about 19 inches of dark gray and light brownish gray, very firm clay and clay loam. It is calcareous and has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous, mottled clay loam. In some places the surface layer is more than 6 inches thick. In other places the subsurface layer is mixed with the upper part of the subsoil. The underlying material has thin layers of silt loam, sandy loam, or sand in some areas. In other areas a seasonal high water table is at a depth of about 4 feet.

Typically, the Jerauld soil has a surface layer of dark gray silt loam about 2 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark gray and brown, very firm and firm silty clay about 12 inches thick. It has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous silty clay and silty clay loam. It is mottled in the lower part. In places, the subsoil is not a dense claypan and nests of salts are in the surface layer and throughout the subsoil.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is olive brown, light olive brown, and pale yellow, friable clay loam about 25 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous loam. It has nests and threads of lime and gypsum crystals.

Included with these soils in mapping are small areas of Davison, Hoven, Prosper, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Davison soils occur as narrow bands around depressions. They contain lime in the surface layer. The Hoven and Tetonka soils are in the deeper depressions and are poorly drained. The moderately well drained Prosper soils do not have a dense claypan subsoil. They are in positions on the landscape similar to those of the Dudley soil. Also included are slickspots and other small, bare areas that are very saline.

Fertility is medium in the Dudley and Clarno soils and low in the Jerauld soil. Organic matter content is moderate in the Dudley and Clarno soils and low in the Jerauld soil. Available water capacity is moderate or high in the Dudley and Jerauld soils and high in the Clarno soil. Permeability is slow or very slow in the Dudley and Jerauld soils. It is moderate in the subsoil of the Clarno soil and moderately slow in the underlying material. Runoff is slow on all three soils. Root penetration is restricted in the Dudley and Jerauld soils. The shrink-swell potential is high in the subsoil of the Dudley and Jerauld soils and moderate in the Clarno soil.

Most areas support native grass and are used for grazing or hay. These soils are best suited to range. Plant growth is restricted in the Dudley and Jerauld soils because of the shallow root zone. The natural plant cover mainly is western wheatgrass, needlegrasses, and blue grama. Overused areas are dominated by blue grama and buffalograss. Saltgrass increases in extent if areas of the Jerauld soil are overused.

The Clarno soil is suitable for cultivated crops, but it occurs as areas so closely intermingled with areas of the unsuited Jerauld and the poorly suited Dudley soils that cropping it separately is not feasible. In the few areas that are used as cropland, crop growth is restricted and tilth is poor in the Dudley and Jerauld soils because of the dense claypan subsoil and the accumulations of sodium salts. Deep tillage and crop residue management improve fertility and tilth.

Generally, these soils are unsuited to windbreaks and environmental plantings. Selected species can be established on the Clarno soil, but trees or shrubs do not grow well on the Dudley and Jerauld soils.

These soils can be used for tame pasture and hay. Forage production is limited, however, by the shallow root zone in the Dudley and Jerauld soils. It is especially low on the Jerauld soils. The Dudley and Clarno soils are suited to alfalfa, crested wheatgrass, and intermediate wheatgrass.

Because of the high shrink-swell potential, the Dudley and Jerauld soils generally are unsuitable as sites for buildings. The Clarno soil is a better site, but the shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling of the Clarno soil. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste. The Dudley and Jerauld soils generally are unsuitable as septic tank absorption fields because of the very restricted permeability.

The Dudley soil is in capability subclass IVs, Claypan range site; the Jerauld soil is in capability subclass VIs, Thin Claypan range site; the Clarno soil is in capability subclass IIc, Silty range site.

Dh—Durrstein silt loam. This deep, poorly drained, nearly level soil is in broad drainageways. It is frequently flooded for brief periods. The surface generally is smooth and slightly concave, but in places many low mounds are interspersed between small depressions. Areas are irregular in shape and range from 5 to more than 1,000 acres in size.

Typically, the surface layer is gray silt loam about 1 inch thick. The subsoil is dark gray and gray, very firm clay about 11 inches thick. In the lower part it is mottled and calcareous and has spots and threads of salts. The upper part of the underlying material is gray, calcareous clay. The lower part to a depth of about 60 inches is gray, mottled, calcareous silty clay. In places the underlying material is stratified with fine sand, silt loam, and very fine sandy loam between depths of 24 and 40 inches. In some areas the surface layer has spots of salts. The subsoil is sandy clay loam in places.

Included with this soil in mapping are small areas of Artesian, Clamo, Dudley, Farmsworth, Fedora, Whitelake, and Woonsocket soils. These soils make up less than 15 percent of any one mapped area. The Artesian, Dudley, Whitelake, and Woonsocket soils are on slight rises and are moderately well drained. The Clamo soils are along stream channels. They have a lower content of salts than the Durrstein soil, and they lack columnar structure in the subsoil. The Farmsworth soils are on slight rises and are somewhat poorly drained. The Fedora soils are along drainageways. They contain more sand than the Durrstein soil. Also included are small, very saline areas that support no vegetation.

The Durrstein soil is low in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is slow or very slow in the subsoil. A seasonal high water table is within a depth of 1.5 feet. In wet years as much as 0.5 foot of water ponds on the surface. Runoff is very slow. The shrink-swell potential is high. In cultivated areas the plow layer is very hard when dry and very sticky when wet.

Most areas support native grass and are used for grazing and hay. A few areas are used for tame pasture, alfalfa, or small grain. This soil is best suited to range. The native vegetation mainly is salt tolerant grasses, such as western wheatgrass, cordgrass, and saltgrass. Overused areas are dominated by saltgrass. The surface soil compacts and the plant community deteriorates if the areas are grazed when wet. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the dense claypan subsoil, the high content of salts, and the wetness.

This soil is poorly suited to building site development because of the flooding, the wetness, and the high shrink-swell potential. It generally is unsuitable as a site for sanitary facilities because of the flooding, the wetness, and the restricted permeability.

The capability subclass is VIw; Saline Lowland range site.

Dk—Durrstein-Farmsworth complex. These deep, nearly level, sodium affected soils are in broad, low lying areas on uplands. The poorly drained Durrstein soil is in the concave low lying areas, and the somewhat poorly drained Farmsworth soil is on mounds. The surface is uneven because many low mounds are interspersed between the concave areas. The Farmsworth soil is subject to rare flooding, and the Durrstein soil is frequently flooded for brief periods. Areas are irregular in shape and are as much as several hundred acres in size. They are 40 to 60 percent Durrstein soil and 30 to 40 percent Farmsworth soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Durrstein soil has a surface layer of gray silt loam about 2 inches thick. The subsoil is a dense claypan of dark gray, very firm clay about 16 inches thick. In the lower part it is mottled and has accumulations of salts. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay and silty clay. In places, the subsoil is not a dense claypan and the surface layer has accumulations of salts. In some areas layers of gravelly sand, silt loam, or loam are 40 to 60 inches from the surface.

Typically, the Farmsworth soil has a surface layer of dark gray loam about 4 inches thick. The subsurface layer is gray clay loam about 2 inches thick. The subsoil is a dense claypan of dark gray and gray, very firm clay about 22 inches thick. In the lower part it is mottled and calcareous and has accumulations of salts. The underlying material to a depth of 60 inches is grayish brown, light gray, and light brownish gray, mottled, calcareous clay and sandy clay loam. In places layers of

sand, silt loam, loam, and clay are 40 to 60 inches from the surface.

Included with these soils in mapping are small areas of Artesian, Whitelake, and Woonsocket soils. These included soils make up less than 20 percent of any one mapped area. The Artesian soils are in positions on the landscape similar to those of the Farmsworth soil. They do not have a dense claypan subsoil or accumulations of salts. The Whitelake and Woonsocket soils are on the slightly higher parts of the landscape. They contain more sand in the subsoil than the Durrstein or Farmsworth soils. Also included are slickspots or other small bare areas that are extremely saline.

The Durrstein soil is low in fertility, and the Farmsworth soil is medium in fertility. Both soils are moderate in content of organic matter. Both have a sodium affected subsoil. Available water capacity is low or moderate in the Durrstein soil and moderate in the Farmsworth soil. Permeability is slow or very slow in both soils. The Durrstein soil has a seasonal water table within a depth of 1.5 feet. In wet periods as much as 0.5 foot of water ponds on this soil. The Farmsworth soil has a seasonal high water table at a depth of 3 to 6 feet. Runoff is slow on both soils. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. A few areas are used as cropland. These soils are best suited to range. The natural plant cover on the Durrstein soil mainly is western wheatgrass, cordgrass, and saltgrass. The natural plant cover on the Farmsworth soil mainly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by saltgrass, blue grama, and buffalograss. Grazing when the soils are wet causes surface compaction and deterioration of the plant community. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

These soils are poorly suited to tame pasture and hay because of the wetness and poor tilth. The Durrstein soil is suited to tall wheatgrass and western wheatgrass and the Farmsworth soil to alfalfa, crested wheatgrass, and intermediate wheatgrass. Deferred grazing during wet periods helps to keep the pasture in good condition.

Because of the dense claypan subsoil, the high content of sodium, and the wetness, these soils are poorly suited to cultivated crops and to windbreaks and environmental plantings. Selected trees or shrubs can be established if they are planted by hand, but optimum survival, growth, and vigor are unlikely.

These soils are poorly suited to building site development because of the flooding, the wetness, and the high shrink-swell potential. They generally are unsuitable as sites for sanitary facilities because of the wetness, the flooding, and the restricted permeability.

The Durrstein soil is in capability subclass VIw, Saline Lowland range site; the Farmsworth soil is in capability subclass IVs, Claypan range site.

Ea—Elsmere loamy fine sand, loamy substratum. This deep, somewhat poorly drained, nearly level soil is in areas on uplands where many low ridges are interspersed between shallow swales and depressions. Areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 6 inches thick. The subsurface layer is dark gray loamy fine sand about 10 inches thick. The next 9 inches is dark grayish brown, mottled loamy fine sand. The upper part of the underlying material, to a depth of about 45 inches, is light brownish gray and light gray, mottled, calcareous loamy fine sand and fine sand. The lower part to a depth of 60 inches is light gray, mottled, calcareous, stratified silt loam and very fine sandy loam. In some places the underlying material is silt loam and very fine sandy loam between depths of 20 and 40 inches. In other places it is fine sand to a depth of 60 inches or more. In some areas gravelly sand is between depths of 40 and 60 inches.

Included with this soil in mapping are small areas of Doger, Forestburg, Orwet, and Shue Variant soils. These included soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Doger soils and the moderately well drained Forestburg soils are on the higher parts of the landscape. The poorly drained Orwet soils are on the lower parts of the landscape. They contain lime in the surface layer. The Shue Variant soils are in depressions and swales and are poorly drained.

The Elsmere soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is rapid in the upper part of the soil and moderately slow in the silty and loamy part of the underlying material. A seasonal high water table is at a depth of 1.5 to 2.5 feet. Runoff is slow.

Most areas are used as cropland. This soil is better suited to close-sown crops, such as small grain and alfalfa, than to row crops. Melons, squash, and pumpkins are grown in places. Controlling soil blowing is the main concern of management. Conserving moisture and improving fertility are other concerns. Minimum tillage and field windbreaks help to control soil blowing and conserve moisture. Regular additions of commercial fertilizer and manure improve fertility.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. A cover crop and crop residue management help to control soil blowing before the pasture is established.

This soil is well suited to range. A protective plant cover helps to control soil blowing. The natural plant cover dominantly is big bluestem and a lesser amount of switchgrass and indiangrass. Overused areas are dominated by Kentucky bluegrass and sedges. The seasonal high water table provides additional moisture to plants. Many areas are potential sites for excavated ponds.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well. The seasonal high water table provides extra moisture to trees and shrubs for most of the growing season. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing. In cultivated areas cover crops or a mulch of crop residue reduces the risk of soil blowing before the windbreak is established.

This soil is poorly suited to most kinds of building site development and sanitary facilities because of the wetness.

The capability subclass is IVe; Subirrigated range site.

Eb—Elsmere-Orwet complex. These deep, nearly level soils are in areas on uplands where many low ridges are interspersed between swales and depressions. The somewhat poorly drained Elsmere soil is on the low ridges and in the swales. The poorly drained Orwet soil is in the lower lying depressions. It is subject to rare flooding. Areas are irregular in shape and range from 10 to 300 acres in size. They are about 60 percent Elsmere soil and 20 to 30 percent Orwet soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Elsmere soil has a surface layer of dark gray loamy fine sand about 6 inches thick. The subsurface layer is dark gray loamy fine sand about 10 inches thick. The next 9 inches is dark grayish brown, mottled loamy fine sand. The upper part of the underlying material, to a depth of about 45 inches, is light brownish gray and light gray, mottled, calcareous loamy fine sand and fine sand. The lower part to a depth of 60 inches is light gray, mottled, calcareous, stratified silt loam and very fine sandy loam. In some places the underlying material is silt loam, silty clay loam, and very fine sandy loam between depths of 20 and 40 inches. In other places it is fine sand to a depth of 60 inches or more. The surface layer has accumulations of salts in some areas.

Typically, the Orwet soil has a surface layer of dark gray, calcareous fine sandy loam about 6 inches thick. The subsurface layer is gray, calcareous loamy fine sand about 5 inches thick. The next 10 inches is gray, calcareous loamy fine sand. The underlying material to a depth of 60 inches is light gray, light brownish gray, and very dark gray, mottled, calcareous fine sand and loamy fine sand. In places lime is leached to a depth of about 20 inches.

Included with these soils in mapping are small areas of the moderately well drained Davison Variant and Forestburg soils and the somewhat excessively drained Doger soils. These included soils make up less than 20 percent of any one mapped area. They are on the higher parts of the landscape.

The Elsmere and Orwet soils are medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate in the Elsmere soil and low in the Orwet soil. Permeability is rapid in the Orwet soil. It is rapid in the upper part of the Elsmere soil and moderately slow in the underlying material. A seasonal high water table is at a depth of 1.5 to 2.5 feet in the Elsmere soil and is within a depth of 1.0 foot in the Orwet soil. Runoff is slow on both soils.

Most areas are used as cropland. These soils are better suited to close-sown crops, such as small grain and alfalfa, than to row crops. Controlling soil blowing is the main concern of management. Improving fertility, increasing the content of organic matter, and conserving moisture are other concerns. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing, conserve moisture, and increase the content of organic matter. Regular additions of commercial fertilizer and manure improve fertility. Fieldwork commonly is delayed by wetness on the Orwet soil, but underground drains can reduce the wetness if outlets are available.

A cover of tame pasture plants or hay is effective in controlling soil blowing. These soils are suited to alfalfa, Garrison creeping foxtail, and smooth bromegrass. A cover crop helps to control soil blowing before the pasture is established. Once the pasture is established, a good plant cover helps to keep blowouts from forming.

These soils are well suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass and indiangrass. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. The protective plant cover deteriorates in these areas, and blowouts form. The seasonal high water table provides extra moisture during the early part of the growing season. Many areas are potential sites for excavated ponds.

These soils are well suited to windbreaks and environmental plantings. The seasonal high water table provides additional moisture to trees and shrubs. In some areas the Orwet soil is too wet during the spring for some trees and shrubs to grow well. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established.

Areas protected from grazing and other disturbances can provide good habitat for wetland wildlife. Shallow ponds provide open water for waterfowl and furbearers.

Because of the wetness, these soils are poorly suited to most kinds of building site development and sanitary facilities.

The Elsmere soil is in capability subclass IVe, the Orwet soil in capability subclass IVw; both soils are in Subirrigated range site.

EcA—Enet loam, 0 to 2 percent slopes. This well drained, nearly level soil is on uplands and high stream terraces. It is moderately deep over gravelly sand. Areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark gray loam about 8 inches thick. The subsoil is dark gray, dark grayish brown, and grayish brown, friable loam about 19 inches thick. The upper part of the underlying material is light brownish gray, calcareous gravelly loamy sand. The lower part to a depth of 60 inches is pale brown or multicolored, calcareous gravelly sand. In places gravelly sand is 10 to 20 inches from the surface. Some of the lower areas are moderately well drained or somewhat poorly drained. The subsoil is sandy loam in places. The underlying material has thin layers of silt loam and loam in some areas.

Included with this soil in mapping are small areas of Bonilla, Fedora, Hand, and Woonsocket soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Bonilla and Woonsocket soils and the poorly drained Fedora soils are on the lower parts of the landscape. The Hand soils are on small knolls. They are not underlain by gravelly sand.

The Enet soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. This soil is somewhat droughty because the underlying material is rapidly permeable. The subsoil is moderately permeable. Runoff is slow.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is better suited to small grain than to late-maturing crops, such as corn and sorghum. The main concern of management is conserving moisture. Crop residue management and minimum tillage conserve moisture.

This soil is suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is green needlegrass, western wheatgrass, and lesser amounts of bluestems and sideoats grama. Overused areas are dominated by western wheatgrass, blue grama, and needleandthread.

Though this soil is suited to windbreaks and environmental plantings, optimum growth is unlikely because of the droughtiness. Drought resistant trees and shrubs can be established.

This soil is well suited to most kinds of building site development and to septic tank absorption fields. The sides of shallow excavations can cave in, however, unless they are shored, and the effluent from all sanitary facilities can pollute shallow ground water. The soil is a good source of sand and gravel for road surfacing.

The capability subclass is IIIs; Silty range site.

EdB—Enet-Delmont loams, 2 to 6 percent slopes. These gently sloping soils are on terrace ridges and side slopes. They are moderately deep and shallow over gravelly sand. The well drained Enet soil is on the smooth and slightly concave, mid and lower side slopes. The somewhat excessively drained Delmont soil is on the short, convex slopes on narrow ridges and on sharp slope breaks. Areas are irregular in shape and range from 5 to 40 acres in size. They are 50 to 70 percent Enet soil and 20 to 40 percent Delmont soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Enet soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark gray, dark grayish brown, and grayish brown, friable loam about 16 inches thick. The underlying material to a depth of 60 inches is light brownish gray and pale brown, calcareous gravelly loamy sand. In places the surface layer and subsoil are sandy loam. A seasonal high water table is in some of the lower areas. Loam or silt loam glacial drift is at a depth of 40 to 60 inches in places.

Typically, the Delmont soil has a surface layer of dark gray loam about 5 inches thick. The subsoil is dark grayish brown and grayish brown, friable loam about 7 inches thick. The underlying material to a depth of 60 inches is grayish brown and brown, calcareous gravelly loamy sand and gravelly sand. In places the surface layer is sandy loam. Loam or silt loam glacial drift is at a depth of 40 to 60 inches in some areas. In other areas gravelly sand is within 10 inches of the surface.

Included with these soils in mapping are small areas of Bonilla, Hand, Tetonka, and Woonsocket soils. These included soils make up 5 to 15 percent of any one mapped area. They are not underlain by gravelly sand. The Bonilla and Woonsocket soils are in swales and drainageways and are moderately well drained. The well drained Hand soils are on some of the mid and lower side slopes. The Tetonka soils are in depressions and are poorly drained.

The Enet and Delmont soils are medium in fertility and are moderate in content of organic matter. Available water capacity is low or moderate in the Enet soil and low in the Delmont soil. Permeability is moderate or moderately rapid in the subsoil of both soils and rapid in the underlying material. Runoff is medium.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. These soils are better suited to small grain than to late-maturing crops, such as corn. They are droughty because of the rapidly permeable gravelly underlying material. Conserving moisture and controlling erosion are the main concerns of management. Crop residue management, minimum tillage, and contour farming conserve moisture and help to control erosion. Leaving the surface rough after fall plowing increases the moisture supply because a rough surface catches snow.

These soils are suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. Because the available water capacity is limited, forage production is low.

These soils are suited to range. The natural plant cover is green needlegrass, western wheatgrass, and lesser amounts of bluestems and sideoats grama on the Enet soil. It is needleandthread, grama grasses, and threadleaf sedge on the Delmont soil. Overgrazed areas

are dominated by western wheatgrass and needleandthread on the Enet soil and threadleaf sedge and blue grama on the Delmont soil.

These soils are suited to windbreaks and environmental plantings. Optimum survival and growth of most trees and shrubs is unlikely, however, because of the droughtiness.

Though these soils are well suited to building site development, the sides of shallow excavations can cave in unless they are shored. Septic tank absorption fields function well on these soils, but the effluent from all sanitary facilities can pollute shallow ground water. The soils are a good source of sand and gravel for road surfacing.

The Enet soil is in capability subclass IIIe, Silty range site; the Delmont soil is in capability subclass IVe, Shallow to Gravel range site.

EeC—Ethan-Clarno loams, 6 to 9 percent slopes. These deep, well drained, moderately sloping and gently rolling soils are on ridges and along drainageways in the uplands. The Ethan soil is on the convex, upper slopes and on ridgetops. The Clarno soil is on the smooth, mid and lower side slopes and on the broader ridgetops. A few glacial stones commonly are on the surface. Areas generally are long and narrow and range from 5 to 100 acres in size. They are about 40 to 50 percent Ethan soil and 30 to 40 percent Clarno soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Ethan soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 18 inches of dark grayish brown and light brownish gray, friable, calcareous loam and clay loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 25 inches of olive brown, light olive brown, and pale yellow, friable clay loam and loam. The underlying material to a depth of 60 inches is pale yellow, calcareous loam.

Included with these soils in mapping are small areas of Bonilla and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Bonilla soils are in swales and are moderately well drained. The Tetonka soils are in depressions and are poorly drained.

The Clarno and Ethan soils are medium in fertility and moderate in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Runoff is medium. The shrink-swell potential is moderate.

About half of the areas are used as cropland, and half are used for range. Controlling erosion is the main concern in managing cultivated areas. These soils are better suited to close-sown crops, such as small grain and alfalfa, than to row crops because of the erosion hazard. Crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility and tilth.

A cover of tame pasture plants or hay is effective in controlling erosion. Alfalfa, smooth bromegrass, and intermediate wheatgrass are suitable.

The Clarno soil is well suited to the trees and shrubs grown as windbreaks and environmental plantings, but optimum growth and survival are unlikely on the Ethan soil. Planting windbreaks on the contour helps to control erosion.

These soils are well suited to range. The natural plant cover mainly is green needlegrass, western wheatgrass, and lesser amounts of bluestems and sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

The shrink-swell potential and the slope are limitations if these soils are used for building site development. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

These soils are poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste. Land shaping and installation of distribution lines across the slope generally are necessary before the absorption field can function properly.

The Ethan soil is in capability subclass IVe, the Clarno soil in capability subclass IIIe; both soils are in Silty range site.

Fa—Fedora fine sandy loam. This deep, nearly level, poorly drained soil is in depressions and drainageways. Areas generally are long and narrow and range from 5 to 80 acres in size.

Typically, the surface layer is very dark gray, calcareous fine sandy loam about 10 inches thick. The next 5 inches is dark gray, calcareous fine sandy loam. The underlying material to a depth of 60 inches is light brownish gray and light gray, mottled, calcareous fine sandy loam, sandy loam, and loamy fine sand. In some places, it is gravelly sand or it is silt loam and loam between depths of about 20 and 60 inches. In other places lime is leached to a depth of 20 to 30 inches. Accumulations of salts are in the surface layer in some areas.

Included with this soil in mapping are small areas of Blendon, Carthage, Elsmere, Tetonka Variant, and Woonsocket soils. These soils make up 15 to 25 percent of any one mapped area. Their surface layer does not contain lime. The well drained Blendon and moderately well drained Carthage and Woonsocket soils are on the

higher parts of the landscape. The somewhat poorly drained Elsmere and poorly drained Tetonka Variant soils are in positions on the landscape similar to those of the Fedora soil.

The Fedora soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is moderately rapid. A seasonal high water table is at a depth of 1 to 4 feet. Runoff is slow.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is best suited to the crops that are planted late in the spring, such as corn and sorghum, because wetness often delays planting. Melons, squash, and pumpkins are grown in some areas. Controlling soil blowing and improving fertility are concerns of management. Stubble mulching, crop residue management, minimum tillage, stripcropping, and field windbreaks help to control soil blowing and improve fertility.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established.

This soil is well suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass and indiangrass. Overused areas are dominated by wheatgrass, saltgrass, and Kentucky bluegrass. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

This soil is poorly suited to building site development and sanitary facilities because of the wetness.

The capability subclass is IIIw; Subirrigated range site.

FbA—Forestburg loamy fine sand, 0 to 2 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Areas are irregular in shape and are as much as several hundred acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 6 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 13 inches thick. The next 5 inches is grayish brown loamy fine sand. The upper part of the underlying material, to a depth of about 28 inches, is brown loamy fine sand. The lower part to a depth of 60 inches is light brownish gray, mottled, calcareous loam and clay loam. In places loam or clay loam glacial till is between depths of 40 and 60 inches.

Included with this soil in mapping are small areas of Clarno, Hand, Elsmere, Orwet, and Shue soils. These soils make up less than 15 percent of any one mapped area. The Clarno and Hand soils are on slight rises. They contain more clay in the subsoil than the Forestburg soil. The somewhat poorly drained Elsmere and Shue and poorly drained Orwet soils are in swales and depressions.

The Forestburg soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is rapid in the upper part of the soil and moderately slow in the underlying material. A seasonal high water table is at a depth of 2.5 to 4.0 feet during wet periods. Runoff is slow. The shrink-swell potential is moderate in the underlying material.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is better suited to close-sown crops, such as small grain, than to row crops. Melons, squash, and pumpkins are grown in some areas. Controlling soil blowing is the main concern of management. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing and conserve moisture. Planting winter cover crops and keeping the surface rough through emergency tillage also reduce soil losses.

This soil is best suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, sand dropseed, and sideoats grama. The major concern in managing range is the hazard of soil blowing.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that require an abundant moisture supply, most of the climatically adapted species grow well. Cover crops and a mulch of crop residue help to control soil blowing before windbreaks are established. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing.

Because of the seasonal high water table, this soil generally is unsuitable as a site for buildings with basements. The seasonal high water table and the shrink-swell potential are limitations on sites for buildings without basements. Installing a drainage system around the buildings and reinforcing footings and foundations help to prevent the structure damage caused by shrinking and swelling. Measures that control soil blowing are needed during construction. This soil is poorly suited to septic tank absorption fields because the seasonal high water table interferes with the functioning of the absorption system.

The capability subclass is IVe; Sandy range site.

FcB—Forestburg-Ethan loamy fine sands, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The moderately well drained Forestburg soil is on the smooth and concave, mid and lower side slopes. The well drained Ethan soil is on convex ridgetops and the upper side slopes (fig. 6). Areas are irregularly shaped and range from 5 to 300 acres in size. They are 60 to 70 percent Forestburg soil and 20 to 30 percent

Ethan soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Forestburg soil has a surface layer and a subsurface layer of dark grayish brown loamy fine sand about 19 inches thick. The next 5 inches is grayish brown loamy fine sand. The upper part of the underlying material, to a depth of about 28 inches, is brown loamy fine sand. The lower part to a depth of 60 inches is light brownish gray, mottled, calcareous loam and clay loam. In places loam or clay loam glacial till is at a depth of 10 to 20 inches or 40 to 60 inches.

Typically, the Ethan soil has a surface layer of dark grayish brown loamy fine sand about 7 inches thick. The subsoil is dark grayish brown and light brownish gray, friable loam about 13 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam. In places the surface layer is sandy loam. In some areas the soil is deeper to free carbonates.

Included with these soils in mapping are small areas of Elsmere, Hand, Orwet, and Shue soils. These included soils make up less than 20 percent of any one mapped area. The Hand soils are in positions on the landscape similar to those of the Ethan soil. They are leached of carbonates to a greater depth than the Ethan and Forestburg soils. The somewhat poorly drained Elsmere and Shue and poorly drained Orwet soils are in depressions and drainageways.

The Forestburg and Ethan soils are medium in fertility and moderate in content of organic matter. Available water capacity is moderate in the Forestburg soil and high in the Ethan soil. Permeability is moderate in the upper part of the Ethan soil and rapid in the upper part of the Forestburg soil. It is moderately slow in the underlying material of both soils. The Forestburg soil has a seasonal high water table at a depth of 2.5 to 4.0 feet during wet periods. Runoff is slow on the Forestburg soil and medium on the Ethan soil. The shrink-swell potential is moderate in the underlying material of both soils.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. These soils are better suited to close-sown crops, such as small grain, than to row crops. Melons, squash, and pumpkins are grown in some areas. Conserving moisture and controlling erosion and soil blowing are the main concerns of management. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing and conserve moisture. Planting winter cover crops and keeping the surface rough through emergency tillage also help to control soil blowing.

These soils are best suited to range. The natural plant cover mainly is bluestems and prairie sandreed. If the range is overgrazed, the natural grasses lose vigor and the bluestems are replaced by prairie sandreed, sand dropseed, and sideoats grama. The major concern of management is the hazard of soil blowing.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass,

Figure 6.—An area of Forestburg-Ethan loamy fine sands, 2 to 6 percent slopes. The well drained Ethan soil is in the higher lying areas.

and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

These soils are suited to windbreaks and environmental plantings. Except for those trees and shrubs that require an abundant moisture supply, most of the climatically adapted species grow well on the Forestburg soil. Optimum growth is unlikely, however, on the Ethan soil. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing.

Because it is wet, the Forestburg soil is more poorly suited to building site development than the Ethan soil. The shrink-swell potential of the Ethan soil is a limitation, but backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Measures that control soil blowing are needed during construction.

These soils are poorly suited to septic tank absorption fields. The seasonal high water table in the Forestburg soil interferes with the functioning of the absorption system. The restricted permeability in the Ethan soil is a limitation, but it can be overcome by enlarging the absorption area.

The Forestburg soil is in capability subclass IVe, the Ethan soil in capability subclass IIIe; both soils are in Sandy range site.

FcC—Forestburg-Ethan loamy fine sands, 6 to 9 percent slopes. These deep, moderately sloping soils are on ridges and breaks along streams and drainageways in the uplands. Areas are long and narrow and range from 5 to 45 acres in size. They are 50 to 60 percent Forestburg soil and 30 to 40 percent Ethan soil. The moderately well drained Forestburg soil is on the concave, mid and lower side slopes. The well drained Ethan soil is on the convex, upper side slopes. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Forestburg soil has a surface layer and a subsurface layer of dark grayish brown loamy fine sand about 19 inches thick. The next 5 inches is grayish brown loamy fine sand. The upper part of the underlying material, to a depth of about 28 inches, is brown loamy fine sand. The lower part to a depth of 60 inches is light brownish gray, mottled, calcareous loam and clay loam. In places loam and clay loam glacial till is at a depth of 10 to 20 inches or 40 to 60 inches.

Typically, the Ethan soil has a surface layer of dark grayish brown loamy fine sand about 7 inches thick. The subsoil is dark grayish brown and light brownish gray, friable loam about 13 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam. In places the surface layer is fine sandy loam. In some areas the soil is deeper to free carbonates.

Included with these soils in mapping are small areas of the well drained Hand soils. These included soils make up less than 15 percent of any one mapped area. They are in positions on the landscape similar to those of the Ethan soil. They are leached of carbonates to a greater depth than the Ethan and Forestburg soils.

The Forestburg and Ethan soils are medium in fertility and moderate in content of organic matter. Available water capacity is moderate in the Forestburg soil and high in the Ethan soil. Permeability is moderate in the upper part of the Ethan soil and rapid in the upper part of the Forestburg soil. It is moderately slow in the underlying material of both soils. The Forestburg soil has a seasonal high water table at a depth of 2.5 to 4.0 feet during wet periods. Runoff is slow on the Forestburg soil and medium on the Ethan soil. The shrink-swell potential is moderate in the underlying material of both soils.

Most areas support native grass and are used for grazing or hay. A few areas are used for tame pasture or hay. These soils are best suited to range. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, sand dropseed, and sideoats grama.

These soils are suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

These soils are suited to windbreaks and environmental plantings. Optimum growth is unlikely, however, on the Ethan soil. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing and erosion. Cover crops and a mulch of crop residue also help to control soil blowing before the windbreak is established.

Because it is wet, the Forestburg soil is more poorly suited to building site development than the Ethan soil. The slope is a limitation on building sites. Buildings should be designed to conform to the natural slope of the land. Considerable land shaping is needed in some areas. The shrink-swell potential of the Ethan soil is a limitation, but backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Measures that control erosion and soil blowing are needed during construction.

These soils are poorly suited to septic tank absorption fields. The seasonal high water table in the Forestburg soil interferes with the functioning of the absorption system. The restricted permeability in the Ethan soil is a limitation, but it can be overcome by enlarging the absorption area. Land shaping and installation of distribution lines across the slope generally are necessary before the absorption field can function properly.

The Forestburg soil is in capability subclass VIe, the Ethan soil in capability subclass IVe; both soils are in Sandy range site.

HaA—Hand-Bonilla loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Hand soil is on slight rises. The moderately well drained Bonilla soil is in swales. It is frequently flooded for very brief periods. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 40 to 50 percent Hand soil and 25 to 35 percent Bonilla soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Hand soil has a surface layer of grayish brown loam about 9 inches thick. The subsoil is light olive brown and light yellowish brown, friable loam about 15 inches thick. It is calcareous in the lower part. The upper part of the underlying material is light gray and pale olive, calcareous silt loam and loam. The lower part to a depth of 60 inches is multicolored, stratified loamy and sandy sediments. The underlying material is clay loam in some areas.

Typically, the Bonilla soil has a surface layer of dark gray loam about 9 inches thick. The subsoil is dark gray and light brownish gray, friable loam about 24 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silt loam and stratified loam, silt loam, and sandy loam. In places the surface layer is fine sandy loam. The underlying material is clay loam in some areas.

Included with these soils in mapping are small areas of Carthage, Tetonka, and Woonsocket soils. These included soils make up less than 25 percent of any one mapped area. The Carthage and Woonsocket soils are in swales. They contain more sand than the Bonilla soil. The Tetonka soils are in depressions and are poorly drained.

The Hand soil is medium in fertility and moderate in content of organic matter. The Bonilla soil is high in fertility and in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderate or moderately slow in the underlying material. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most areas are used as cropland. These soils are well suited to all of the cultivated crops commonly grown in the county. Conserving moisture is the main concern of management. Crop residue management and minimum tillage conserve moisture. Planting and harvesting are delayed during wet periods in some areas of the Bonilla soil.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well.

These soils are well suited to range. The natural plant cover on the Hand soil is green needlegrass, bluestems, western wheatgrass, and lesser amounts of sideoats grama. Overgrazed areas are dominated by western wheatgrass and needleandthread. The natural plant cover on the Bonilla soil dominantly is big bluestem and lesser amounts of western wheatgrass. Overused areas are dominated by western wheatgrass and Kentucky bluegrass.

The Bonilla soil generally is unsuitable as a site for buildings because it is subject to flooding. The Hand soil is a better site, but the shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Bonilla soil generally is not suitable as a septic tank absorption field because of the flooding and the wetness. The Hand soil is a better site, but the restricted permeability is a limitation. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The capability is subclass IIc; the Hand soil is in Silty range site, the Bonilla soil in Overflow range site.

HbB—Hand-Ethan loams, 2 to 6 percent slopes. These deep, well drained, undulating soils are on uplands. The Hand soil is on the smooth or slightly convex, mid and lower side slopes. The Ethan soil is on narrow, convex ridges and the upper side slopes. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 50 to 60 percent Hand soil and 20 to 30 percent Ethan soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Hand soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is about 16 inches of dark grayish brown, light brownish gray, and light yellowish brown, friable loam and silt loam. It is calcareous in the lower part. The upper part of the underlying material is light gray and pale olive, calcareous silt loam and loam. The lower part to a depth of 60 inches is multicolored, stratified loamy and sandy sediments. The underlying material is firm clay loam in some areas.

Typically, the Ethan soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 18 inches of dark grayish brown and light brownish gray, friable, calcareous loam and silt loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silt loam, loam, and very fine sandy loam. It is stratified in the lower part.

Included with these soils in mapping are small areas of Bonilla, Carthage, Tetonka, and Woonsocket soils. These included soils make up less than 25 percent of any one mapped area. The Bonilla, Carthage, and Woonsocket soils are in drainageways and on the concave, lower side slopes and are moderately well drained. The Tetonka soils are in depressions and are poorly drained.

The Hand and Ethan soils are moderate in fertility and medium in content of organic matter. Available water

capacity is high in both soils. Permeability is moderate in the Hand soil. It is moderate in the subsoil of the Ethan soil and moderately slow in the underlying material. Runoff is medium on both soils. The shrink-swell potential is moderate.

Most areas are used as cropland. These soils are well suited to all of the cultivated crops commonly grown in the county. Controlling erosion is the main concern of management. Improving fertility and conserving moisture are other concerns. Crop residue management, minimum tillage, and contour farming help to control erosion, conserve moisture, and improve tilth and fertility.

A cover of tame pasture plants or hay is effective in controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

Windbreaks and environmental plantings can be established on these soils. Optimum growth, however, is unlikely on the Ethan soil. Planting trees and shrubs on the contour helps to control erosion.

These soils are well suited to range. The natural plant cover is green needlegrass, western wheatgrass, and lesser amounts of bluestems and sideoats grama. Overused areas are dominated by western wheatgrass and needleandthread.

The shrink-swell potential is a limitation if these soils are used as sites for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The restricted permeability is a limitation if these soils are used as septic tank absorption fields. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste.

The Hand soil is in capability subclass IIe, the Ethan soil in capability subclass IIIe; both soils are in Silty range site.

HcB—Houdek-Dudley complex, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The well drained Houdek soil is on smooth and convex side slopes and on ridgetops. The moderately well drained Dudley soil is on concave side slopes and in swales and shallow depressions. In most areas a few glacial stones are on the surface. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 40 to 50 percent Houdek soil and 25 to 35 percent Dudley soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Houdek soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous clay loam.

Typically, the Dudley soil has a surface layer of dark gray silt loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 2 inches thick. The subsoil is about 23 inches thick. It is dark gray and dark grayish brown, firm clay loam over pale brown, friable, calcareous silty clay loam. It has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is pale brown, calcareous clay loam. In places the surface layer is 10 to 22 inches thick. In some of the lower lying areas, a seasonal high water table is at a depth of about 4 feet.

Included with these soils in mapping are small areas of Davison, Ethan, Hoven, Jerauld, Prosper, and Tetonka soils. These included soils make up less than 30 percent of any one mapped area. The Davison soils are on the rims around depressions. They contain lime in the surface layer. The Ethan soils are on narrow ridges and convex side slopes. They have lime within 9 inches of the surface. The Hoven and Tetonka soils are in depressions and are poorly drained. The Jerauld soils are in positions on the landscape similar to those of the Dudley soil. They have visible salts at a depth of 5 to 16 inches. Their surface layer is thinner than that of the Dudley or Houdek soil. The moderately well drained Prosper soils do not have a sodium affected subsoil. Also included are slickspots or other bare areas that are very saline.

The Houdek and Dudley soils are medium in fertility and moderate in content of organic matter. Available water capacity is high in the Houdek soil and moderate or high in the Dudley soil. Permeability is moderate in the subsoil of the Houdek soil and very slow in the subsoil of the Dudley soil. It is moderately slow or slow in the underlying material of both soils. Runoff is medium on the Houdek soil and slow on the Dudley soil. The shrink-swell potential is moderate in the Houdek soil and high in the Dudley soil.

Most areas are used for tame pasture or for range. These soils are suited to tame pasture and hay. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are suited to range. The natural plant cover mainly is green needlegrass, bluestems, and western wheatgrass. Overused areas are dominated by western wheatgrass, sedges, and blue grama.

Crop growth is restricted on the Dudley soil because of the dense claypan subsoil. As a result, early maturing crops, such as small grain, and drought-resistant crops, such as sorghum, are better suited than corn. Controlling erosion, conserving moisture, and increasing the rate of water intake are the main concerns of management. Crop residue management and minimum tillage conserve moisture and help to control erosion. Deep tillage helps to break up the dense claypan subsoil in the Dudley soil and increases the rate of water intake.

The Houdek soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well, except for those that require an

abundant moisture supply. The Dudley soil is poorly suited to windbreaks. Some climatically adapted trees and shrubs can be established, but optimum growth and survival are unlikely.

Because of the high shrink-swell potential, the Dudley soil does not provide a stable base for buildings. The Houdek soil is a better building site, but its moderate shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by the shrinking and swelling of this soil. Reinforcing foundations and footings also helps to prevent this damage.

The Dudley soil generally is unsuitable as a septic tank absorption field because of very restricted permeability. The Houdek soil is poorly suited because of restricted permeability, but enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The Houdek soil is in capability subclass IIe, Silty range site; the Dudley soil is in capability subclass IVs, Claypan range site.

HdB—Houdek-Ethan loams, 2 to 6 percent slopes. These deep, well drained, gently sloping and undulating soils are on uplands. The Houdek soil is on the smooth or convex, mid and lower side slopes and on the broader ridgetops. The Ethan soil is on short, convex slopes on narrow ridgetops and the upper side slopes. A few glacial stones are on the surface in most areas. In some areas the surface is very stony. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 50 to 60 percent Houdek soil and 20 to 30 percent Ethan soil. The two soils occur in areas so intermingled or so small that mapping them separately is not practical.

Typically, the Houdek soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous clay loam.

Typically, the Ethan soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 18 inches of dark grayish brown and light brownish gray, friable, calcareous loam and clay loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam.

Included with these soils in mapping are small areas of Dudley, Hoven, Prosper, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Dudley soils are on concave side slopes and in swales and shallow depressions. They have a sodium affected subsoil. The Hoven and Tetonka soils are in depressions and are poorly drained. The Prosper soils are in swales and drainageways and are moderately well drained.

The Houdek and Ethan soils are medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate in the subsoil and moderately slow in the underlying material. Runoff is medium. The shrink-swell potential is moderate.

About half of the areas are used for cultivated crops, and half are used for range. A few areas support tame pasture plants or hay. These soils are well suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Controlling erosion and conserving moisture are the main concerns in managing cultivated areas. Crop residue management, minimum tillage, contour farming, and grassed waterways help to control erosion, conserve moisture, and improve fertility and tilth.

These soils are well suited to range. The natural plant cover mainly is green needlegrass, western wheatgrass, and bluestems. Overused areas are dominated by western wheatgrass and needleandthread.

A cover of tame pasture plants or hay is effective in controlling erosion. Alfalfa, smooth bromegrass, and intermediate wheatgrass are suitable.

The Houdek soil is well suited to the trees and shrubs grown as windbreaks and environmental plantings, but optimum growth is unlikely on the Ethan soil. Planting windbreaks on the contour helps to control erosion.

The shrink-swell potential is a limitation if these soils are used as sites for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

These soils are poorly suited to septic tank absorption fields because of restricted permeability. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste.

The Houdek soil is in capability subclass IIe, the Ethan soil in capability subclass IIIe; both soils are in Silty range site.

HeA—Houdek-Prosper loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Houdek soil is on smooth and slightly convex slopes on the higher parts of the landscape. The moderately well drained Prosper soil is in swales and shallow depressions. It is frequently flooded for very brief periods. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 50 to 60 percent Houdek soil and 20 to 40 percent Prosper soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Houdek soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous clay loam.

Typically, the Prosper soil has a surface layer of dark gray loam about 11 inches thick. The subsoil is about 19

inches thick. It is dark gray and dark grayish brown, firm clay loam in the upper part and light yellowish brown, friable, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is light gray and light brownish gray, mottled, calcareous loam and clay loam. In places the subsoil is silty clay.

Included with these soils in mapping are small areas of Davison, Dudley, Stickney, Hoven, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Davison soils occur as narrow bands around depressions. They contain lime in the surface layer. The Dudley and Stickney soils are in positions on the landscape similar to those of the Prosper soil. They have a sodium affected subsoil. The Hoven and Tetonka soils are in depressions and are poorly drained.

The Houdek soil is medium in fertility and moderate in content of organic matter. The Prosper soil is high in fertility and in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. The Prosper soil receives runoff from higher lying soils. It has a seasonal high water table at a depth of 3 to 6 feet. Runoff is slow on both soils. The shrink-swell potential is moderate.

About half of the areas are used as cropland, and half are used for range. A few areas are used for tame pasture and hay. These soils are well suited to cultivated crops. Conserving moisture is the main concern in managing cultivated areas. Improving tilth and fertility is also a concern. Crop residue management, minimum tillage, and applications of fertilizer conserve moisture and improve tilth and fertility. During some wet periods planting and harvesting are delayed on the Prosper soil.

These soils are well suited to range. The natural plant cover mainly is green needlegrass, bluestems, and western wheatgrass. Switchgrass also is extensive on the Prosper soil. Overused areas are dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass grow well.

These soils are well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well.

Because of the flooding, the Prosper soil generally is unsuitable as a site for buildings. The Houdek soil is a better site, but its moderate shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Houdek soil is poorly suited to septic tank absorption fields because of restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste. The Prosper soil is unsuitable as a septic tank absorption field because of the flooding.

The capability subclass is IIc; the Houdek soil is in Silty range site, the Prosper soil in Overflow range site.

HeB—Houdek-Prosper loams, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The well drained Houdek soil is on ridges, knolls, and the upper side slopes. The moderately well drained Prosper soil is in swales and drainageways and on the concave, lower side slopes. It is frequently flooded for very brief periods. In most areas a few glacial stones are on the surface. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 40 to 50 percent Houdek soil and 20 to 30 percent Prosper soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Houdek soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous clay loam.

Typically, the Prosper soil has a surface layer of dark gray loam about 11 inches thick. The subsoil is about 19 inches thick. It is dark gray and dark grayish brown, firm clay loam in the upper part and light yellowish brown, friable, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is light gray and light brownish gray, mottled, calcareous loam and clay loam. In places the subsoil is silty clay.

Included with these soils in mapping are small areas of Davison, Dudley, Ethan, Hoven, and Tetonka soils. These included soils make up less than 25 percent of any one mapped area. The Davison soils are on the rims around depressions. They contain lime in the surface layer. The Dudley soils are in positions on the landscape similar to those of the Prosper soil. They have a dense, sodium affected subsoil. The Ethan soils are on narrow ridgetops and on convex side slopes. They have lime near the surface. The Hoven and Tetonka soils are in depressions and are poorly drained.

The Houdek soil is medium in fertility and moderate in content of organic matter. The Prosper soil is high in fertility and in content of organic matter. Available water capacity is high in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. The Prosper soil receives runoff from higher lying soils. It has a seasonal high water table at a depth of 3 to 6 feet. Runoff is medium on the Houdek soil and slow on the Prosper soil. The shrink-swell potential is moderate in both soils.

Most areas are used as cropland or for tame pasture and hay. Some areas support native grass and are used for grazing or hay. These soils are well suited to all of the crops commonly grown in the county. Controlling erosion and conserving moisture are the main concerns

of management. Crop residue management, minimum tillage, and contour farming help to control erosion, conserve moisture, and improve tilth and fertility.

A cover of tame pasture plants or hay is effective in controlling erosion. These soils are well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass.

These soils are well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well.

These soils are well suited to range. The natural plant cover mainly is green needlegrass, bluestems, and western wheatgrass. Overused areas are dominated by western wheatgrass and needleandthread.

Because of the flooding, the Prosper soil generally is unsuitable as a site for buildings. The Houdek soil is a better site, but its moderate shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Houdek soil is poorly suited to septic tank absorption fields because of restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste. The Prosper soil is unsuitable as a septic tank absorption field because of the flooding and the wetness.

The capability subclass is IIe; the Houdek soil is in Silty range site, the Prosper soil in Overflow range site.

HfA—Houdek-Stickney loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Houdek soil is on the higher parts of the landscape. The moderately well drained Stickney soil is in concave, low lying areas and in swales. Areas are irregular in shape and range from 5 to several hundred acres in size. They are 50 to 60 percent Houdek soil and 20 to 30 percent Stickney soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Houdek soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 19 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous clay loam. In places the surface layer is fine sandy loam. In some areas the underlying material has thin layers of silt loam or fine sand.

Typically, the Stickney soil has a surface layer of dark gray loam about 7 inches thick. The subsurface layer is grayish brown silt loam about 3 inches thick. The next 2 inches is dark grayish brown silty clay loam and light brownish gray silt loam. The subsoil is about 24 inches of very dark gray and grayish brown, firm silty clay, clay, and clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and pale yellow, calcareous clay loam. The lower part of the subsoil and the underlying material have visible salts. In places the surface layer is fine sandy loam. In some areas the boundary between the subsurface layer and the claypan subsoil is abrupt. The underlying material has thin layers of silt loam, very fine sandy loam, or fine sand in places. In some small areas a seasonal high water table is at a depth of 3 to 5 feet.

Included with these soils in mapping are small areas of Davison, Dudley, Hoven, Jerauld, Prosper, and Tetonka soils. These included soils make up less than 25 percent of any one mapped area. The Davison soils are on the rims around depressions. They contain lime in the surface layer. The Dudley soils have columnar structure in the subsoil. The Dudley, Jerauld, and Prosper soils are in positions on the landscape similar to those of the Stickney soil. The Jerauld soils have salts near the surface. The Hoven and Tetonka soils are in depressions and are poorly drained. Also included are slickspots or other bare areas that are very saline.

The Houdek and Stickney soils are medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is slow in the Stickney soil. Runoff is slow on both soils. The shrink-swell potential is moderate in the Houdek soil and high in the Stickney soil.

Most areas are used for tame pasture and for cultivated crops. A few areas support native grass and are used for grazing and hay. The Stickney soil is better suited to early maturing crops, such as small grain, and drought-resistant crops, such as sorghum, than to corn because it is droughty late in summer. Conserving moisture and improving tilth are the main concerns of management. Crop residue management and minimum tillage conserve moisture and improve tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs grow well.

These soils are well suited to range. The natural plant cover mainly is green needlegrass, bluestems, and western wheatgrass and, on the Stickney soil, lesser amounts of bluestems. Overused areas are dominated by western wheatgrass, needleandthread, and blue grama.

Because of the high shrink-swell potential, the Stickney soil provides an unstable base for buildings. The Houdek soil is a better building site, but its moderate shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by the shrinking and swelling of this soil. Reinforcing foundations and footings also helps to prevent this damage.

The Stickney soil generally is unsuitable as a septic tank absorption field because of very restricted

permeability. The Houdek soil is poorly suited because of restricted permeability, but enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The Houdek soil is in capability subclass IIc, Silty range site; the Stickney soil is in capability subclass IIIs, Clayey range site.

Hk—Hoven silt loam. This nearly level, poorly drained soil is in depressions in the uplands. It is frequently flooded. Areas generally are circular and are about 4 to 20 acres in size.

Typically, the surface layer is gray silt loam about 3 inches thick. The subsoil is about 28 inches thick. It is dark gray, very firm clay in the upper part and grayish brown, mottled, firm clay loam in the lower part. It has spots of salts in the lower part. The underlying material to a depth of 60 inches is gray and light gray, calcareous clay loam.

Included with this soil in mapping are small areas of Davison, Dudley, and Tetonka soils. These soils make up less than 10 percent of any one mapped area. The Davison and Dudley soils occur as narrow bands around depressions and are moderately well drained. The Tetonka soils are in the lowest part of the depressions. They do not have salts in the subsoil. Their surface layer is thicker than that of the Hoven soil. Also included are small, bare areas that are very saline.

The Hoven soil is medium in fertility and moderate in content of organic matter. Available water capacity is low to high. Permeability is very slow. A seasonal high water table is within a depth of 1.5 feet. In wet years as much as 1 foot of water ponds on the surface. The shrink-swell potential is high in the subsoil.

Most areas support native grass and are used for grazing or hay. This soil is best suited to range. The natural plant cover dominantly is western wheatgrass and lesser amounts of sedges. Overused areas are dominated by Kentucky bluegrass and saltgrass. Sedges and rushes increase in extent during wet years, and buffalograss increases in extent during periods of drought. Grazing when the soil is wet causes surface compaction and deterioration of the plant community. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

This soil generally is unsuitable for cultivated crops and for windbreaks and environmental plantings. The thin surface layer, the dense, compact subsoil, and the ponding are the main limitations.

This soil is poorly suited to building site development and sanitary facilities because of the ponding and the wetness.

The capability subclass is VIs; Closed Depression range site.

HmA—Hoven-Durrstein silt loams, 0 to 2 percent slopes. These deep, poorly drained, nearly level soils are in broad, flat-bottomed drainageways and low lying areas in the uplands. They are frequently flooded. The Hoven soil is in depressions, and the Durrstein soil is on slight rises. Areas are irregular in shape and range from 5 to 50 acres in size. They are 40 to 50 percent Hoven soil and 30 to 40 percent Durrstein soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Hoven soil has a surface layer of gray silt loam about 3 inches thick. The subsoil is about 28 inches thick. It is dark gray, very firm clay in the upper part and grayish brown, mottled, firm clay loam in the lower part. The underlying material to a depth of 60 inches is gray and light gray, mottled, calcareous clay loam.

Typically, the Durrstein soil has a surface layer of gray silt loam about 1 inch thick. The subsoil is dark gray and gray, very firm clay about 11 inches thick. In the lower part it is mottled and calcareous and has nests and threads of salts. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay and silty clay. In places many nests and threads of salts are in the surface layer. On some of the higher parts of the landscape, a seasonal high water table is below a depth of 6 feet.

Included with these soils in mapping are small areas of the moderately well drained Davison and Dudley soils and the well drained Houdek soils. These included soils make up about 10 percent of any one mapped area. They are on the higher parts of the landscape.

The Hoven soil is medium in fertility, and the Durrstein soil is low in fertility. Both soils are moderate in content of organic matter. Available water capacity is low to high in the Hoven soil and low or moderate in the Durrstein soil. Permeability is slow in the Hoven soil and slow or very slow in the Durrstein soil. Both soils have a seasonal high water table within a depth of 1.5 feet. In wet periods as much as 1 foot of water ponds on the surface. Runoff is very slow or ponded. Accumulations of salts and the dense claypan subsoil restrict root penetration. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. These soils are best suited to range. The natural plant cover on the Hoven soil dominantly is western wheatgrass and lesser amounts of sedges. The natural plant cover on the Durrstein soil is salt tolerant grasses, such as cordgrass, alkaligrass, western wheatgrass, and saltgrass. Overused areas are dominated by Kentucky bluegrass and saltgrass. Grazing when the soils are wet causes surface compaction and deterioration of the plant community. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

These soils generally are unsuitable for cultivated crops and for windbreaks and environmental plantings. The thin surface layer, the dense, compact subsoil, and the ponding are the main limitations.

These soils generally are unsuitable as sites for buildings and sanitary facilities because of the flooding and the wetness.

The capability subclass is VIs; the Hoven soil is in Closed Depression range site, the Durrstein soil in Saline Lowland range site.

Ia—Ipage-Els loamy fine sands. These deep, gently undulating soils are on uplands. The moderately well drained Ipage soil is on low ridges and mounds, and the somewhat poorly drained Els soil is in swales and depressions. Areas are irregular in shape and range from 10 to 400 acres in size. They are 45 to 55 percent Ipage soil and 30 to 40 percent Els soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Ipage soil has a surface layer of dark gray loamy fine sand about 6 inches thick. The next 3 inches is grayish brown loamy fine sand. The underlying material to a depth of 60 inches is pale brown and gray fine sand and loamy sand. In places it is silt loam, silty clay loam, or clay loam between depths of 40 and 60 inches.

Typically, the Els soil has a surface layer of dark grayish brown, mottled loamy fine sand about 8 inches thick. The next 6 inches is grayish brown, mottled fine sand. The underlying material is pale brown, light brownish gray, and gray, mottled fine sand and loamy fine sand. It is calcareous in the lower part. In places it is silt loam, silty clay loam, or clay loam between depths of 30 and 60 inches.

Included with these soils in mapping are small areas of Orwet and Valentine soils. These included soils make up less than 20 percent of any one mapped area. The Orwet soils are on the lowest parts of the landscape. They contain lime in the surface layer. The Valentine soils are on the higher parts of the landscape and are excessively drained.

The Ipage and Els soils are low in fertility and in content of organic matter. Available water capacity is low. Permeability is rapid. A seasonal high water table is at a depth of 3 to 6 feet in the Ipage soil and at a depth of 1.5 to 3.5 feet in the Els soil. Runoff is slow on both soils.

Most areas support native grass and are used for grazing. These soils are well suited to range. The natural plant cover mainly is bluestems, switchgrass, indiangrass, cordgrass, and prairie sandreed. Overused areas are dominated by prairie sandreed, sideoats grama, western wheatgrass, and Kentucky bluegrass. The protective plant cover deteriorates in these areas, and blowouts form. An adequate plant cover and ground mulch help to control soil blowing and increase the moisture supply. Many areas are potential sites for excavated ponds.

These soils are better suited to close-sown crops, such as small grain and alfalfa, than to row crops. Melons are grown in places. The main concern in managing cultivated areas is controlling soil blowing. Conserving moisture, improving fertility, and increasing the content of organic matter are other concerns. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing and conserve moisture.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

These soils are suited to windbreaks and environmental plantings. The seasonal high water table provides extra moisture to the trees during most of the growing season. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing. A cover crop or a mulch of crop residue helps to control soil blowing before the windbreak is established.

These soils generally are unsuitable for most kinds of building site development and sanitary facilities because of the wetness.

The capability subclass is IVe; the Ipage soil is in Sandy range site, the Els soil in Subirrigated range site.

Ja—James silty clay. This level, poorly drained, saline soil is on flood plains. It is frequently flooded. Areas generally are long and narrow and range from 10 to 300 acres in size.

Typically, the surface layer is very dark gray and dark gray, calcareous silty clay about 10 inches thick. It has spots and threads of salts. The subsoil is about 22 inches of dark gray and gray, mottled, firm, calcareous silty clay and silty clay loam. It has spots and threads of salts. The underlying material to a depth of 60 inches is gray and dark gray, mottled, calcareous silty clay loam and silty clay. In places the surface layer is light gray silt loam and does not have salts. In some areas lime is leached to a depth of 10 inches or more.

Included with this soil in mapping are small areas of Clamo soils. These soils make up less than 10 percent of any one mapped area. They are in positions on the landscape similar to those of the James soil. They do not have salts near the surface.

The James soil is high in fertility and in content of organic matter. Available water capacity is low or moderate. Permeability is slow. A seasonal high water table is within a depth of 1 foot. Runoff is slow. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. This soil is best suited to range. The natural plant cover is salt tolerant grasses, such as cordgrass, western wheatgrass, switchgrass, and saltgrass. Overused areas are dominated by saltgrass. The soil is wet for long periods. Grazing or haying when the soil is wet causes surface compaction and deterioration of the plant community. Restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

This soil is poorly suited to cultivated crops and to windbreaks and environmental plantings because of the flooding, the slow runoff, and a concentration of salts in the root zone. Installing surface drainage systems and planting salt tolerant crops help to overcome the adverse effects of the flooding and the salts. Salt tolerant grasses, such as tall wheatgrass and western wheatgrass, are the best species to plant on tame pasture.

Areas of this soil can provide habitat for wetland wildlife if they are protected from grazing. Shallow ponds can be constructed to provide open water areas.

This soil is unsuitable as a site for buildings and sanitary facilities because of the wetness and the flooding.

The capability subclass is IVw; Saline Lowland range site.

La—Lamo silty clay loam. This deep, somewhat poorly drained, nearly level soil is on flood plains that generally are cut by meandering stream channels. It is occasionally flooded. Areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is dark gray silty clay loam about 5 inches thick. The subsurface layer is gray, mottled, calcareous silty clay loam about 12 inches thick. The next 15 inches is gray, mottled, calcareous silty clay loam. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam. In places a thin layer of light brownish gray silt loam is at the surface.

Included with this soil in mapping are small areas of Clamo soils. These soils make up less than 10 percent of any one mapped area. They are in low lying areas. They contain more clay than the Lamo soil.

The Lamo soil is high in fertility and in content of organic matter. Available water capacity is high. Permeability is moderately slow. A seasonal high water table is at a depth of 2 to 3 feet. Runoff is slow. The shrink-swell potential is high.

About half the areas are used for cultivated crops, and half are used for range. A few areas support tame pasture plants and hay. This soil is well suited to all of the crops commonly grown in the county. The main concerns of management are controlling the seasonal wetness and improving tilth. The wetness caused by the seasonal high water table and the flooding delays fieldwork in some years. Crop residue management, minimum tillage, and timely tillage improve tilth and fertility. Surface drains and underground drains can lower the water table in areas where outlets are available.

This soil is well suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass, indiangrass, and cordgrass. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. A planned grazing system that includes restricted use during wet periods helps to prevent compaction of the soil and helps to keep the range in good condition.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. The seasonal high water table provides additional moisture to plants early in the growing season.

If drained, this soil is well suited to windbreaks and environmental plantings. Trees and shrubs receive additional moisture from the overflow water and the seasonal high water table. In undrained areas the seasonal high water table limits the kinds of trees and shrubs that grow well.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding and the wetness.

The capability subclass is IIw; Subirrigated range site.

Lb—Lute fine sandy loam. This deep, nearly level, somewhat poorly drained soil is in broad basins. It is subject to rare flooding. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is gray fine sandy loam about 2 inches thick. The subsoil is about 14 inches thick. The upper part is dark gray, firm, calcareous sandy clay loam. The lower part is grayish brown and light brownish gray, mottled, friable, calcareous fine sandy loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous loamy fine sand. In places the surface layer is more than 2 inches thick, is sandy clay loam, or is calcareous loamy fine sand. Some areas on the lower parts of the landscape are poorly drained.

Included with this soil in mapping are small areas of Whitelake and Woonsocket soils. These soils make up less than 15 percent of any one mapped area. They are on the higher parts of the landscape. Their surface layer is thicker than that of the Lute soil. Also included are bare areas that are very saline.

The Lute soil is low in fertility and moderate in content of organic matter. Permeability is slow in the subsoil and moderate or moderately rapid in the underlying material. Available water capacity is low to high. A seasonal high water table is at a depth of 1 to 5 feet in most years. Runoff is slow or very slow. The subsoil is mildly alkaline to strongly alkaline.

Most areas support native grass. This soil is best suited to range. The native plant cover mainly is cordgrass, western wheatgrass, and saltgrass. Overused areas are dominated by saltgrass. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to windbreaks and environmental plantings, to cultivated crops, and to tame pasture and hay because of the dense claypan subsoil and the high content of sodium salts. It is unsuitable as a site for buildings and sanitary facilities because of the wetness and the flooding.

The capability subclass is VIs; Saline Lowland range site.

Lc—Lute fine sandy loam, ponded. This deep, poorly drained, nearly level soil is in broad basins and in depressions. It is frequently ponded for very long periods. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is gray fine sandy loam about 2 inches thick. The subsoil is about 17 inches thick. It is dark gray, firm, calcareous sandy clay loam in the upper part and grayish brown and light brownish gray, mottled, friable, calcareous sandy clay loam in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous loamy fine sand. In places the surface layer is silty clay.

Included with this soil in mapping are slickspots or other bare areas that are very saline. These areas are at the edge of the basins and depressions.

The Lute soil is low in fertility and moderate in content of organic matter. Permeability is slow in the subsoil and moderate and moderately rapid in the underlying material. Available water capacity is low to high. A seasonal high water table is within a depth of 3 feet. As much as 1 foot of water ponds on the surface during wet periods.

Most areas support native vegetation of rushes, cattails, and other aquatic plants and are used as wildlife habitat. This soil is best suited to wetland wildlife habitat. The aquatic plants provide good habitat for wetland wildlife. Shallow excavations provide open water areas most of the year. The habitat should be protected from grazing.

This soil is unsuited to cultivated crops and to tame pasture and hay, range, windbreaks and environmental plantings, building site development, and sanitary facilities because of the wetness and the ponding. Outlets for artificial drainage systems generally are not available.

The capability subclass is VIIIw; no range site is assigned.

LdA—Lute-Whitelake fine sandy loams, 0 to 2 percent slopes. These deep, nearly level soils are in broad, low lying areas in the uplands. The somewhat poorly drained Lute soil is in shallow depressions, and the moderately well drained Whitelake soil is on slight rises. Areas are irregular in shape and range from 5 to 40 acres in size. They are 40 to 60 percent Lute soil and 20 to 40 percent Whitelake soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Lute soil has a surface layer of gray fine sandy loam about 2 inches thick. The subsoil is about 14 inches thick. It is dark gray, firm, calcareous sandy clay loam in the upper part and grayish brown and light brownish gray, mottled, friable, calcareous fine sandy loam in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous loamy fine sand. In places the subsoil has nests and threads of salts.

Typically, the Whitelake soil has a surface layer of dark gray fine sandy loam about 8 inches thick. The subsurface layer is gray loamy fine sand about 4 inches thick. The subsoil is grayish brown, firm sandy clay loam about 15 inches thick. It has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown sandy loam. It is mottled and calcareous in the lower part. In places the subsoil does not have nests and threads of salts.

Included with these soils in mapping are small areas of Blendon, Davison Variant, Doger, Elsmere, Forestburg, and Shue soils. These included soils make up less than 15 percent of any one mapped area. They do not have a firm, sodium affected subsoil. The well drained Blendon and somewhat excessively drained Doger soils are on the highest parts of the landscape. The Davison Variant soils are on the slight rises between depressions. They contain lime in the surface layer. The Elsmere, Forestburg, and Shue soils are in positions on the landscape similar to those of the Whitelake and Lute soils. Also included are some bare areas that are very saline.

The Lute soil is low in fertility, and the Whitelake soil is medium in fertility. Both soils are moderate in content of organic matter. Available water capacity is low to high. Permeability is slow in the subsoil. The Lute soil has a seasonal high water table at a depth of 1 to 5 feet and the Whitelake soil at a depth of 2 to 4 feet. Runoff is slow or very slow. The subsoil of both soils is mildly alkaline to very strongly alkaline.

Most areas support native grass and are used for grazing or hay. These soils are best suited to range. The natural plant cover is cordgrass, western wheatgrass, and saltgrass on the Lute soil and bluestems and prairie sandreed on the Whitelake soil. Overused areas are dominated by prairie sandreed, western wheatgrass, and sideoats grama. Saltgrass increases in extent if areas of the Lute soil are overgrazed. Grazing when the soil is wet causes surface compaction and deterioration of the plant community. An adequate plant cover helps to control soil blowing when the surface is dry. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition.

These soils generally are unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. Selected trees and shrubs can be established on the Whitelake soil, but no trees or shrubs grow well on the Lute soil.

These soils are poorly suited to most kinds of building site development and sanitary facilities because of the wetness. Buildings without basements can be constructed on the Whitelake soil if a drainage system is installed around the footings.

The Lute soil is in capability subclass VIs, Saline Lowland range site; the Whitelake soil is in capability subclass IVe, Sandy range site.

Oa—Orwet fine sandy loam. This deep, poorly drained soil is in slight depressions in the uplands. It is

subject to rare flooding in wet years. Areas are irregular in shape and range from 5 to 90 acres in size.

Typically, the surface layer is dark gray, calcareous fine sandy loam about 6 inches thick. The subsurface layer is gray, calcareous loamy fine sand about 5 inches thick. The next 10 inches is gray, calcareous loamy fine sand. The underlying material to a depth of 60 inches is light gray, light brownish gray, and very dark gray, mottled, calcareous fine sand and loamy fine sand. In places it is fine sandy loam or is stratified with silt loam, silty clay loam, loam, or very fine sandy loam below a depth of 40 inches.

Included with this soil in mapping are small areas of Doger, Els, Elsmere, Forestburg, Ipage, and Shue soils. These soils make up less than 15 percent of any one mapped area. They are not so poorly drained as the Orwet soil and are at the edge of the depressions or on small mounds and ridges in some of the larger depressions.

The Orwet soil is low in fertility and moderately low in content of organic matter. Available water capacity is low. Permeability is rapid. A seasonal high water table is within a depth of 1 foot. Runoff is slow.

Most areas are used for range or for tame pasture and hay. A few areas are used for cultivated crops. Some of the cropland is used for wildlife habitat. This soil is well suited to range. The natural plant cover mainly is big bluestem and lesser amounts of switchgrass, indiangrass, and cordgrass. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. Forage production on well managed range is high because of the additional moisture provided by the seasonal high water table. A protective plant cover helps to control soil blowing. Many areas are potential sites for excavated ponds.

A cover of tame pasture plants or hay is effective in controlling soil blowing. This soil is suited to alfalfa, Garrison creeping foxtail, and smooth bromegrass. The choice of grasses is limited somewhat by the wetness unless an artificial drainage system is installed. The seasonal high water table is within the root zone early in the growing season.

If drained, this soil is suited to cultivated crops. It is better suited to late-planted crops, such as corn and sorghum, than to small grain. Soil blowing is a severe hazard in cultivated areas. Crop residue management and minimum tillage conserve moisture, increase the content of organic matter, and help to control soil blowing. Stripcropping and field windbreaks also help to control soil blowing.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well in drained areas, but only the trees and shrubs that can tolerate wetness grow well in undrained areas. Cover crops and a mulch of crop residue help to control soil blowing before the windbreak is established. Planting trees in sod and otherwise minimizing the extent of ground preparation also help to control soil blowing.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the wetness.

The capability subclass is IVw; Subirrigated range site.

Pa—Pits, gravel. This map unit consists of open excavations, 5 to 30 feet deep, from which sand and gravel have been removed. Areas are irregular in shape and range from 2 to 50 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottom to almost vertical on the rims. Some of the pit bottoms are covered with water.

The pit bottoms typically are sand and gravel but are loam or clay loam glacial till or silty glacial drift where the sand and gravel have been removed. Mounds of mixed loamy overburden are on the edges of the pits. They support annual weeds. The bottom and sides support little or no vegetation.

Most gravel pits are used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to range, tame pasture, or cropland if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden as topsoil dressing. Applying fertilizer as needed helps to establish the range or pasture.

The capability subclass is VIIIs; no range site is assigned.

Sa—Shue-Davison loamy fine sands. These deep, nearly level soils are on uplands. The somewhat poorly drained Shue soil is in swales and shallow depressions. It is subject to rare flooding. The moderately well drained Davison soil is on low ridges and mounds. Areas are irregular in shape and range from 10 to several hundred acres in size. They are 70 percent Shue soil and generally 20 to 30 percent Davison soil. Some of the long, narrow areas are less than 20 percent Davison soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Shue soil has a surface layer of dark grayish brown loamy fine sand about 7 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 8 inches thick. The upper part of the underlying material is light olive brown, mottled loamy fine sand. The lower part to a depth of 60 inches is light brownish gray and light gray, mottled, calcareous clay loam and loam. In places loamy fine sand or fine sand is below a depth of 40 inches. The surface layer has spots and threads of salts in some areas.

Typically, the Davison soil has a surface layer of dark grayish brown loamy fine sand about 7 inches thick. The next 4 inches is grayish brown, calcareous loam. The upper part of the underlying material is light gray, mottled, calcareous clay loam. The lower part to a depth of 60 inches is gray, mottled, calcareous, stratified loam, silt loam, and sandy loam. In some areas the surface layer is sandy loam.

Included with these soils in mapping are small areas of Forestburg, Orwet, and Tetonka soils. These included

soils make up less than 25 percent of any one mapped area. The Forestburg soils are on the higher parts of the landscape and are moderately well drained. They do not contain lime in the surface layer. The Orwet and Tetonka soils are in depressions and are poorly drained.

The Shue and Davison soils are medium in fertility and moderate in content of organic matter. Available water capacity is moderate or high in the Shue soil and high in the Davison soil. Permeability is rapid in the sandy upper part of the Shue soil and moderately slow in the underlying material. It is moderate in the Davison soil. The Shue soil has a seasonal high water table at a depth of 1 to 3 feet and the Davison soil at a depth of 1.5 to 6 feet. Runoff is slow on both soils. The shrink-swell potential is moderate in the underlying material.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. These soils are better suited to close-sown crops, such as small grain and alfalfa, than to row crops. Melons, pumpkins, and squash are grown in some areas. Soil blowing is the main concern of management. Conserving moisture and improving fertility are other concerns. The wetness caused by the seasonal high water table delays fieldwork in wet years. Stripcropping, crop residue management, minimum tillage, and field windbreaks help to control soil blowing and conserve moisture. Regular additions of fertilizer improve fertility.

A cover of tame pasture plants or hay is effective in controlling soil blowing. These soils are suited to alfalfa, Garrison creeping foxtail, and smooth bromegrass. Seeding cover crops or incorporating the residue of the previous crop into the soil helps to control soil blowing before the pasture is established.

These soils are well suited to range. The natural plant cover mainly is bluestems, needlegrass, and lesser amounts of switchgrass and indiangrass. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. An adequate plant cover and ground mulch help to control soil blowing. Many areas are potential sites for ponds.

These soils are well suited to windbreaks and environmental plantings (fig. 7). All climatically adapted trees and shrubs grow well. Planting trees in sod and otherwise minimizing the extent of ground preparation and planting a cover crop or mulching with crop residue help to control soil blowing before the windbreak is established. After the windbreak is established, the seasonal high water table provides additional moisture during the early part of the growing season.

These soils are poorly suited to most kinds of building site development and sanitary facilities because of the wetness.

Figure 7.—Field windbreaks on Shue-Davison loamy fine sands. These windbreaks help to control soil blowing.

The capability subclass is IVe; the Shue soil is in Subirrigated range site, the Davison soil in Limy Subirrigated range site.

Sb—Shue Variant loamy fine sand. This deep, nearly level, poorly drained soil is in depressions and drainageways. It is frequently flooded. Areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark gray, mottled loamy fine sand about 6 inches thick. The subsurface layer is dark grayish brown, mottled loamy fine sand about 6 inches thick. The next 5 inches is grayish brown, mottled loamy fine sand. The upper 19 inches of the underlying material is light brownish gray, mottled loamy fine sand. The next 10 inches is a buried surface layer of dark gray, mottled silt loam. The lower part of the underlying material to a depth of 60 inches is light gray, mottled silty clay loam. In some places the surface layer is calcareous and has spots and threads of salts. In other places the contrasting loamy underlying material is at a depth of 40 to 60 inches. In some areas fine sand is at a depth of 60 inches or more. On the slightly higher parts of the landscape, the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Davison and Lute soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Davison soils are on low mounds. They contain lime in the surface layer. The somewhat poorly drained Lute soils are on the outer edges of the depressions and drainageways. Their subsoil is finer textured than that of the Shue Variant soil.

The Shue Variant soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate or high. Permeability is rapid in the upper part of the soil and moderately slow in the underlying material. A seasonal high water table is within a depth of 4 feet. As much as 1 foot of water ponds on the surface during wet periods. Runoff is very slow. The shrink-swell potential is moderate in the underlying material.

Most areas support native grass and are used for grazing or hay. A few areas are used for tame pasture and hay. This soil is best suited to range. The natural plant cover dominantly is cordgrass and lesser amounts of switchgrass, indiangrass, and big bluestem. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. The seasonal high water table provides extra moisture to plant roots during most of the growing season. Range in poor condition is susceptible to severe soil blowing.

If this soil is used for tame pasture and hay, only water tolerant species, such as Garrison creeping foxtail and reed canarygrass, are suitable. Overuse decreases the extent of the protective plant cover and results in susceptibility to soil blowing.

Areas of this soil can provide excellent habitat for wetland wildlife if they are protected from grazing. Shallow ponds can be constructed to provide open water areas for waterfowl and furbearers.

This soil generally is unsuited to cultivated crops, to windbreaks and environmental plantings, and to building site development and sanitary facilities because of the wetness.

The capability subclass is Vw; Subirrigated range site.

Ta—Tetonka loamy fine sand, overblown. This deep, poorly drained, nearly level soil is in depressions in the uplands. It is frequently flooded. Areas are circular and oblong and range from 4 to 20 acres in size.

Typically, the surface layer is grayish brown, mottled loamy fine sand about 10 inches thick. The subsurface layer is light brownish gray, mottled loam about 4 inches thick. The subsoil is gray, very firm silty clay about 19 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light olive gray and light gray, mottled, calcareous clay loam. In places the surface layer is fine sandy loam.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is very slow. A perched water table is within a depth of 1 foot most of the year. As much as 1 foot of water ponds on the surface during wet periods. The shrink-swell potential is high.

Most areas are used as cropland. A few areas support native grass and are used for grazing and hay. This soil is better suited to late-planted crops, such as corn and sorghum, than to early sown crops. The wetness caused by ponding and the seasonal high water table commonly delays fieldwork. During dry periods the soil is subject to soil blowing. Crop residue management, minimum tillage, and timely tillage improve tilth and help to control soil blowing.

This soil is well suited to tame pasture and hay. Garrison creeping foxtail, reed canarygrass, and smooth bromegrass are suitable. A cover crop helps to control soil blowing before the pasture is established.

This soil is well suited to windbreaks and environmental plantings. The trees and shrubs that require an abundant moisture supply are especially well suited. Planting trees and shrubs in sod and otherwise minimizing the extent of ground preparation help to control soil blowing.

This soil is suited to range. The natural plant cover mainly is reedgrass, prairie cordgrass, western wheatgrass, and sedges. Overused areas are dominated by Kentucky bluegrass, western wheatgrass, and saltgrass. Many areas are potential sites for excavated ponds.

Areas of this soil can provide habitat for wetland wildlife if they are protected from grazing. Shallow ponds can be built to provide open water areas for waterfowl and furbearers.

This soil is poorly suited to building site development and most sanitary facilities because of the wetness and the flooding.

The capability subclass is IVw; Wet Meadow range site.

Tb—Tetonka silt loam. This deep, poorly drained, level soil is in depressions, wide swales, and shallow drainageways in the uplands. It is frequently flooded. Areas are circular or long and narrow. They generally are 4 to 40 acres in size, but a few are as large as 80 acres.

Typically, the surface layer is gray silt loam about 8 inches thick. The subsurface layer is light gray, mottled silt loam about 5 inches thick. The next 3 inches is light gray silt loam and dark gray silty clay. The subsoil is about 33 inches of dark gray, gray, and light olive gray, very firm, calcareous silty clay. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam. In places the soil has no subsurface layer.

Included with this soil in mapping are small areas of Davison and Hoven soils. These soils make up less than 10 percent of any one mapped area. The Davison soils are moderately well drained and occur as narrow bands around depressions. They contain lime in the surface layer. The Hoven soils are near the outer edges of depressions. They have a higher content of salts than the Tetonka soil and have a sodium affected subsoil. Their surface layer is less than 8 inches thick.

The Tetonka soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is very slow. A perched water table is within a depth of 1 foot almost all of the year. As much as 1 foot of water ponds on the surface during wet periods. The shrink-swell potential is high.

Most areas are used for cultivated crops. A few areas where surface drainage is poor are used for range or for tame pasture or hay. This soil is suited to corn, sorghum, and small grain and to grasses and legumes for hay or pasture. The wetness caused by flooding and by the seasonal high water table is the main concern of management. If suitable outlets are available, surface drains can be used to remove excess water. Measures that divert runoff from adjacent soils also help to control flooding on this soil. Timely tillage helps to prevent compaction and improves tilth. Returning crop residue to the soil also improves tilth.

If drained, this soil is well suited to tame pasture or hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. To prevent surface compaction, grazing and haying should be delayed when the soil is wet. Many areas are potential sites for excavated ponds.

This soil is well suited to range. The natural plant cover dominantly is sedges, reedgrass, prairie cordgrass, and western wheatgrass. Overused areas are dominated by Kentucky bluegrass, western wheatgrass, and saltgrass. Sedges and rushes increase in extent during wet years. Restricted use during wet periods helps to prevent surface compaction and helps to keep the range in good condition.

Trees and shrubs grow well on this soil if surface drains adequately control the wetness. The soil is well suited to the trees and shrubs that require an abundant moisture supply, such as cottonwoods and willows.

Undrained areas can provide habitat for wildlife if they are protected from grazing. Shallow ponds can be constructed to provide open water areas.

This soil is poorly suited to building site development and to most sanitary facilities because of the flooding and the wetness.

The capability subclass is IVw, undrained, and IIw, drained; Wet Meadow range site.

TcA—Tetonka-Davison-Clarno complex, 0 to 2 percent slopes. These deep, level and nearly level soils are on uplands. The poorly drained Tetonka soil is in depressions. It is frequently flooded. The moderately well drained Davison soil is on the rims around depressions and on low mounds and ridges between the depressions. The moderately well drained Clarno soil is on the highest parts of the landscape. Areas are irregular in shape and range from 5 to 150 acres in size. They are 20 to 40 percent Tetonka soil, 20 to 30 percent Davison soil, and 20 to 30 percent Clarno soil. The three soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Tetonka soil has a surface layer of gray silt loam about 8 inches thick. The subsurface layer is light gray silt loam about 5 inches thick. The next 3 inches is light gray silt loam mixed with dark gray silty clay. The subsoil is about 36 inches of dark gray, gray, and light olive gray, very firm, calcareous silty clay. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam. In some places the soil has no subsurface layer. In other places the silty clay subsoil is within 2 inches of the surface.

Typically, the Davison soil has a surface layer of dark gray, calcareous loam about 8 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous loam that has nests and threads of gypsum crystals. In places the nests and threads of salts are in the surface layer. In some areas the soil contains more sand throughout.

Typically, the Clarno soil has a surface layer of dark gray loam about 6 inches thick. The subsoil is about 25 inches thick. It is brown, friable clay loam in the upper part and pale yellow, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous loam. It has nests and threads of gypsum salts in the lower part. In places the subsoil contains more clay. In some areas the underlying material is stratified with silt loam, very fine sandy loam, and sand.

Included with these soils in mapping are small areas of Dudley, Prosper, and Woonsocket soils. These included soils make up less than 10 percent of any one mapped area. The Dudley soils are on the short side slopes adjacent to depressions. They have a claypan subsoil. The Woonsocket soils are adjacent to sandy soils and contain more sand than the Tetonka, Davison, or Clarno soils. The moderately well drained Prosper soils are in

swales. They have dark colors to a greater depth than the Clarno and Davison soils.

The Tetonka, Davison, and Clarno soils are medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is very slow in the Tetonka soil and moderate in the Davison soil. It is moderate in the subsoil of the Clarno soil and moderately slow in the underlying material. Runoff is slow on all three soils. The Tetonka soil has a perched water table within a depth of 1 foot almost all of the year. As much as 1 foot of water ponds on the surface during some wet periods. The seasonal high water table is perched at a depth of 1.5 to 6 feet in the Davison soil and at a depth of 3.5 to 6 feet in the Clarno soil. The shrink-swell potential is high in the Tetonka soil and moderate in the Clarno and Davison soils.

Most areas are used as cropland. These soils are well suited to corn, sorghum, and small grain and to tame grasses and legumes for pasture and hay. Wetness is the main concern in managing the Tetonka soil. Planting, harvesting, and tilling are often delayed during wet periods. Soil blowing is the main concern in managing the Davison soil. Improving tilth and fertility are other concerns. If suitable outlets are available, surface drains can be used to remove excess water on the Tetonka soil. Returning crop residue to the soil or regularly adding other organic material improves fertility, increases the content of organic matter, and helps to control soil blowing.

These soils are well suited to range. The natural plant cover on the Tetonka soil dominantly is sedges, prairie cordgrass, reedgrass, and western wheatgrass. That on the Davison and Clarno soils dominantly is needlegrass, bluestems, and western wheatgrass. Overused areas are dominated by western wheatgrass and blue grama. Many areas of the Tetonka soil are potential sites for excavated ponds.

These soils are well suited to tame pasture and hay. The Clarno and Davison soils are suited to alfalfa, intermediate wheatgrass, and smooth bromegrass, and the Tetonka soil is suited to Garrison creeping foxtail and reed canarygrass. To prevent surface compaction, grazing and haying should be delayed when the soils are wet. A good plant cover and ground mulch help to control soil blowing on the Davison soil.

These soils are suited to windbreaks and environmental plantings. Surface drainage is needed, however, on the Tetonka soil. The trees and shrubs that require an abundant moisture supply grow well on all of the soils because of the seasonal high water table.

Because of the wetness, the Tetonka and Davison soils generally are unsuitable as sites for buildings. The Clarno soil is a better site, but the shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff from the buildings help to prevent the structural damage caused by the shrinking and swelling of the Clarno soil. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno and Davison soils are poorly suited to septic tank absorption fields because of the restricted permeability and the wetness. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste. Installing a drainage system that lowers the water table helps to overcome the wetness. The Tetonka soil is unsuitable as a septic tank absorption field because of the wetness, the flooding, and the restricted permeability.

The Tetonka soil is in capability subclass IVw, undrained, and IIw, drained, and in Wet Meadow range site; the Davison soil is in capability subclass IIe, Limy Subirrigated range site; the Clarno soil is in capability subclass IIc, Silty range site.

Td—Tetonka Variant fine sandy loam. This deep, nearly level, poorly drained soil is in depressions in the uplands. It is frequently flooded for very long periods. Areas are irregular in shape and range from about 4 to 30 acres in size.

Typically, the surface layer is dark gray fine sandy loam about 9 inches thick. The subsurface layer is about 10 inches of gray fine sandy loam and loamy fine sand. It is mottled in the lower part. The subsoil is gray and grayish brown, mottled, firm sandy clay loam about 15 inches thick. The upper part of the underlying material is grayish brown, mottled fine sandy loam. The lower part to a depth of 60 inches is light gray fine sand. In places the surface layer is calcareous fine sand or loamy fine sand. In some areas the subsoil is clay loam or silty clay.

Included with this soil in mapping are small areas of Carthage, Davison Variant, and Woonsocket soils. These soils make up less than 10 percent of any one mapped area. They are on the slightly higher parts of the landscape and are moderately well drained.

The Tetonka Variant soil is high in content of organic matter and in fertility. Available water capacity is moderate. Permeability is slow in the subsoil and rapid in the underlying material. A seasonal high water table is within a depth of 2 feet. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is very slow.

About half of the areas are used for range, and half are used for cultivated crops. If drained, this soil is suited to corn, small grain, and sorghum. Melons, squash, and pumpkins are grown in some areas. Wetness is the main concern of management. Installing surface and underground drains can reduce the wetness if outlets are available. Late-planted crops, such as corn and sorghum, can be grown if planting is delayed by the wetness. Soil blowing is a minor hazard when the surface is dry. Crop residue management, minimum tillage, and applications of fertilizer improve tilth and fertility and help to control soil blowing.

If drained, this soil is well suited to alfalfa, Garrison creeping foxtail, and smooth bromegrass for tame pasture and hay. Undrained areas are suited to Garrison creeping foxtail, reed canarygrass, and western wheatgrass.

This soil is well suited to range. The natural plant cover dominantly is sedges, prairie cordgrass, reedgrass, and western wheatgrass. Overused areas are dominated by Kentucky bluegrass, western wheatgrass, and saltgrass. Sedges and rushes increase in extent during wet years. Many areas are potential sites for excavated ponds.

If drained, this soil is well suited to windbreaks and environmental plantings. In most areas the extra moisture provided by the seasonal high water table is beneficial. Unless drained, however, some areas are excessively wet or ponded during the spring. A mulch of crop residue helps to control soil blowing before the windbreak is established.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the wetness and the flooding.

The capability subclass is IVw, undrained, and IIw, drained; Wet Meadow range site.

VaC—Valentine fine sand, 3 to 15 percent slopes. This deep, undulating to rolling, excessively drained soil is on rounded ridges and knolls in the uplands. Areas are irregular in shape and range from 5 to 80 acres in size. Slopes are short and convex.

Typically, the surface layer is grayish brown fine sand about 5 inches thick. The next 8 inches is pale brown fine sand. The underlying material to a depth of 60 inches also is pale brown fine sand. In places the surface layer is dark gray loamy fine sand. In some areas loam or clay loam glacial drift is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Els and Elsmere and moderately well drained Ipage soils. These soils make up less than 15 percent of any one mapped area. They are on the lower parts of the landscape.

The Valentine soil is low in fertility and in content of organic matter. Available water capacity is low. Permeability is rapid. Runoff is slow.

Most areas support native grass and are used for grazing. This soil is best suited to range. Controlling soil blowing is the main concern of management. The natural plant cover mainly is bluestems and prairie sandreed. Overused areas are dominated by prairie sandreed, blue grama, and sedges.

Windbreaks and environmental plantings can be established on this soil, but only evergreens are suitable. Planting trees in sod and otherwise minimizing the extent of ground preparation reduce the risk of soil blowing.

This soil is well suited to building site development, but the sides of shallow excavations can cave in unless they are shored. Land leveling is needed in some of the more sloping areas. The soil is suitable as a septic tank absorption field, but the effluent from all sanitary facilities can pollute shallow ground water.

The capability subclass is VIe; Sands range site.

Wa—Wann fine sandy loam. This deep, somewhat poorly drained, nearly level soil is on flood plains. It is occasionally flooded. Areas are long and narrow and range from 10 to several hundred acres in size. A meandering stream channel dissects most areas into small tracts.

Typically, the surface layer is dark gray fine sandy loam about 8 inches thick. The subsurface layer is dark gray, calcareous sandy loam about 7 inches thick. The upper part of the underlying material, to a depth of about 43 inches, is dark gray and dark grayish brown, mottled, calcareous fine sandy loam. The lower part to a depth of 60 inches is grayish brown and light brownish gray, mottled, calcareous loamy fine sand. In some places lime is leached to a depth of more than 20 inches. In other places the surface layer has spots and threads of lime and salts. In some areas overwash of silty clay is on the surface. In the low lying areas adjacent to the stream channel, the surface layer is stratified with gravelly sand to clay loam. Gravelly sand is at a depth of 40 to 60 inches in some areas. Fine sand is below a depth of 20 inches in other areas.

Included with this soil in mapping are small areas of Blendon, Clamo, and Doger soils. These soils make up less than 15 percent of any one mapped area. The well drained Blendon and somewhat excessively drained Doger soils are on the higher parts of the landscape. The Clamo soils are on the lower parts of the landscape and are poorly drained.

The Wann soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate or high. Permeability is moderately rapid. A seasonal high water table is at a depth of 1.5 to 3.5 feet.

Most areas support native grass and are used for grazing. This soil is best suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass, indiangrass, and sedges. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. The major concern of management is the wetness in the spring. Restricted use during wet periods helps to prevent compaction. Measures that control brush are needed in some areas. Examples are spraying with herbicides and mowing.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. Seedbed preparation and planting are delayed by spring flooding in some years.

If this soil is used for cultivated crops, the wetness caused by the flooding and the seasonal water table is the main concern of management. Soil blowing and poor accessibility are other concerns. In years when flooding occurs late in the spring, late-planted crops, such as corn and sorghum, should be grown instead of small grain. Stubble mulching, crop residue management, and minimum tillage conserve moisture, help to control soil blowing, and improve fertility. Most of the areas that are dissected into small tracts by a meandering stream channel are part of adjacent larger fields. The less accessible areas can be used as range.

This soil is suited to windbreaks and environmental plantings, but trees and shrubs can be damaged by floodwater. A mulch of crop residue helps to control soil blowing before the windbreak is established.

Areas of this soil that are protected from grazing provide excellent habitat for wildlife. The intermittent streams provide water for many species of wildlife.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the wetness and the flooding.

The capability subclass is IIIw; Subirrigated range site.

Wb—Wann-Lamo complex. These deep, somewhat poorly drained, nearly level soils are on flood plains. They are occasionally flooded by stream overflow. The Wann soil is on slight rises, and the Lamo soil is in the slightly lower areas. Areas are long and narrow and range from 10 to 200 acres in size. They are 40 to 50 percent Wann soil and 30 to 40 percent Lamo soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Wann soil has a surface layer of dark gray, calcareous loam about 13 inches thick. The next 4 inches is grayish brown, calcareous loam. The underlying material to a depth of about 60 inches is grayish brown, mottled fine sandy loam and loamy fine sand. It is calcareous in the upper part. In places the soil is loam throughout. In some areas a thin layer of silty clay loam or silty clay overwash is on the surface. On some of the higher parts of the landscape, a seasonal high water table is below a depth of 3.5 feet.

Typically, the Lamo soil has a surface layer of dark gray silty clay loam about 5 inches thick. The subsurface layer is gray, mottled, calcareous silty clay loam about 12 inches thick. The next 15 inches is gray, mottled, calcareous silty clay loam. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam. In places both the surface layer and the subsurface layer are silty clay, loam, or fine sandy loam.

Included with these soils in mapping are small areas of Clamo soils. These included soils make up less than 10 percent of any one mapped area. They are in the lower lying concave areas. They contain more clay than the Wann and Lamo soils.

The Wann soil is medium in fertility and moderate in content of organic matter. The Lamo soil is high in fertility and in content of organic matter. Available water capacity is moderate or high in the Wann soil and high in the Lamo soil. Permeability is moderately rapid in the Wann soil and moderately slow in the Lamo soil. A seasonal high water table is at a depth of 1.5 to 3.5 feet in the Wann soil and at a depth of 2 to 3 feet in the Lamo soil. Runoff is slow on both soils. The shrink-swell potential is high in the Lamo soil.

About half of the areas are used for cultivated crops, and half are used for grazing. A few areas are wooded. The wooded areas provide excellent habitat for wildlife if they are protected from grazing. These soils are well suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass, indiangrass, and cordgrass. Overused areas are dominated by Kentucky bluegrass, western wheatgrass, and saltgrass. A planned grazing system that includes restricted use during wet periods helps to prevent surface compaction. Mowing and applying herbicides help to control brush.

These soils are well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. The seasonal high water table provides additional moisture to the tame pasture plants and hay.

These soils are suited to all of the crops commonly grown in the county. The wetness caused by flooding and by the seasonal high water table delays fieldwork in some years, but in most areas drainage is adequate for intensive cropping. If outlets are available, surface and underground drains can lower the seasonal high water table. In wet years late-planted crops, such as corn and sorghum, can be planted instead of small grain. The Wann soil is subject to soil blowing, and the Lamo soil compacts easily and loses tilth if cultivated when wet. Crop residue management, minimum tillage, and timely tillage improve tilth, help to control soil blowing, and keep the soils productive.

These soils are well suited to windbreaks and environmental plantings, but trees and shrubs can be damaged by floodwater. The trees that require an abundant moisture supply are especially well suited. A mulch of crop residue helps to control soil blowing on the Wann soil.

Because of the wetness caused by the flooding and the seasonal high water table, these soils are poorly suited to building site development and sanitary facilities.

The Wann soil is in capability subclass IIIw, the Lamo soil in capability subclass IIw; both soils are in Subirrigated range site.

WcB—Whitelake-Woonsocket fine sandy loams, 2 to 6 percent slopes. These deep, undulating, moderately well drained soils are in areas on uplands where slopes generally are smooth and slightly concave. The Whitelake soil is in shallow depressions and in swales. The Woonsocket soil is on smooth side slopes and in swales. Areas range from 4 to 30 acres in size. They are 40 to 50 percent Whitelake soil and 30 to 40 percent Woonsocket soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Whitelake soil has a surface layer of dark gray fine sandy loam about 8 inches thick. The subsurface layer is gray loamy fine sand about 4 inches thick. The subsoil is grayish brown, firm and friable sandy clay loam about 15 inches thick. It has nests and threads of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown sandy loam. In some

places the surface layer is less than 8 inches thick or does not occur. In other places, the subsoil is sandy clay and the underlying material has layers of loam or very fine sandy loam.

Typically, the Woonsocket soil has a surface layer of dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 20 inches of dark gray, dark grayish brown, and grayish brown, friable fine sandy loam and firm sandy clay loam. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray and brown, mottled, calcareous loamy fine sand and fine sand. On some of the higher parts of the landscape, the soil does not have a seasonal high water table.

Included with these soils in mapping are small areas of Doger and Durrstein soils. These included soils make up less than 20 percent of any one mapped area. The Doger soils are on the highest parts of the landscape. They do not have a seasonal high water table. The Durrstein soils are in deep swales and depressions and are poorly drained.

Fertility is medium in the Whitelake soil and high in the Woonsocket soil. The content of organic matter is moderate in the Whitelake soil and high in the Woonsocket soil. Available water capacity is low to high in both soils. Permeability is slow in the subsoil of the Whitelake soil and moderate or moderately rapid in the underlying material. It is moderate in the subsoil of the Woonsocket soil and moderately rapid or rapid in the underlying material. A seasonal high water table is at a depth of 2 to 4 feet in the Whitelake soil and at a depth of 3 to 6 feet in the Woonsocket soil. Runoff is slow on both soils.

Most areas are used as cropland. These soils are suited to corn, sorghum, and small grain and to grasses and legumes for hay and pasture. Crop growth is restricted on the Whitelake soil because of the claypan subsoil. Controlling soil blowing, improving tilth and fertility, and conserving moisture are the main concerns in managing cultivated areas. Crop residue management, minimum tillage, and stripcropping the larger areas help to control soil blowing, conserve moisture, increase the rate of water intake, improve fertility, and increase the content of organic matter.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. A mulch of crop residue helps to control soil blowing and conserves moisture before the windbreak is established.

These soils are well suited to range. The natural vegetation dominantly is bluestems, needlegrasses, and sideoats grama. Overused areas are dominated by western wheatgrass, blue grama, and Kentucky bluegrass.

Wetness is a limitation if these soils are used as sites for buildings. The higher lying areas of the Woonsocket soil are the better building sites. Installing a drainage system around foundations and footings helps to prevent seepage into basements. Septic tank absorption fields do not function well because of the wetness caused by the seasonal high water table. The effluent from all sanitary facilities can pollute shallow ground water.

The Whitelake soil is in capability subclass IVe, the Woonsocket soil in capability subclass IIIe; both soils are in Sandy range site.

Wd—Woonsocket fine sandy loam. This deep, nearly level, moderately well drained soil is on uplands. Slopes are smooth and slightly concave. Areas are irregular in shape and range from 3 to 70 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 20 inches of dark gray, dark grayish brown, and grayish brown, friable fine sandy loam and firm sandy clay loam. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray and brown, calcareous loamy fine sand and fine sand. It is mottled in the upper part.

Included with this soil in mapping are small areas of Artesian, Blendon, Fedora, and Whitelake soils. These soils make up less than 15 percent of any one mapped area. The Artesian and Whitelake soils are in shallow depressions and swales. The subsoil of Artesian soils contains more clay than that of the Woonsocket soil. The Whitelake soils have a dense, compact subsoil. The Blendon soils are on the higher parts of the landscape and are well drained. The Fedora soils are on the lower parts of the landscape. They contain lime in the surface layer.

The Woonsocket soil is high in fertility and in content of organic matter. Available water capacity is moderate. Permeability is moderate in the subsoil and moderately rapid or rapid in the underlying material. A seasonal high water table is at a depth of 3 to 6 feet. Runoff is slow. The shrink-swell potential is low.

Most areas are used as cropland. This soil is suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Melons, squash, and pumpkins are grown in some areas. Controlling soil blowing and conserving moisture are the main concerns in managing cultivated areas. Stripcropping, field windbreaks, crop residue management, winter cover crops, and minimum tillage help to control soil blowing and conserve moisture. Plowing in the spring instead of the fall also helps to control soil blowing. Regular additions of fertilizer improve fertility.

A cover of tame pasture plants or hay is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. A seasonal high water table provides extra moisture to plants in the early part of the growing season.

This soil is well suited to range. The natural plant cover dominantly is big bluestem and lesser amounts of

western wheatgrass and green needlegrass. Overused areas are dominated by western wheatgrass, saltgrass, and Kentucky bluegrass. The seasonal high water table provides additional moisture to range plants.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well. The seasonal high water table is within the root zone in the early part of the growing season. A mulch of crop residue helps to control soil blowing before the windbreak is established.

Wetness is a limitation if this soil is used as a site for buildings. A drainage system around the footings and foundations helps to keep ground water from seeping into basements. The soil is poorly suited to sanitary facilities because of the wetness caused by the seasonal high water table.

The capability subclass is IIIe; Overflow range site.

We—Worthing silt loam. This deep, poorly drained, level soil is in depressions in the uplands. It is frequently flooded for very long periods. Areas are circular and oblong and range from 5 to 60 acres in size.

Typically, the surface layer is dark gray, mottled silt loam about 10 inches thick. The subsoil is about 30 inches of dark gray and gray, mottled, very firm silty clay. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay loam. In some places the surface layer is fine sandy loam or loam. In other places it is calcareous and has spots and threads of salts. In some areas sand or fine sand is at a depth of 40 to 60 inches. In other areas the subsurface layer is gray or light gray silt loam about 4 to 10 inches thick.

Included with this soil in mapping are small areas of Davison and Fedora soils. These soils make up less than 5 percent of any one mapped area. They are in the slightly higher areas on the outer edges of the depressions. They contain less clay than the Worthing soil.

The Worthing soil is high in fertility and in content of organic matter. Available water capacity is moderate or high. Permeability is slow. A seasonal high water table is within a depth of 1 foot most of the year. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is slow or ponded. The shrink-swell potential is high.

Most areas support native grass and are used for grazing and hay. A few areas that are adequately drained are used as cropland. This soil is suited to range. The natural plant cover dominantly is rivergrass, slough sedge, reedgrass, and prairie cordgrass. Overused areas are dominated by spike sedge and other less palatable plants. A planned grazing system that includes restricted use during wet periods helps to keep the range in good condition.

If drained, this soil is suited to all of the crops commonly grown in the county. Corn, small grain, sorghum, and alfalfa are the main crops. Undrained areas generally are too wet for cultivation. The wetness caused by ponding and the seasonal high water table is the main limitation. If outlets are available, surface drains can be used to remove excess water. Measures that divert runoff from adjacent soils also reduce the wetness. Timely tillage helps to prevent compaction and improves tilth. Returning crop residue to the soil also improves tilth.

If drained, this soil is suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, and smooth bromegrass are suitable. To prevent surface compaction, grazing and haying should be delayed when the soil is wet. Many areas are potential sites for excavated ponds.

Trees and shrubs cannot grow well on this soil because the flooding is a severe hazard and the wetness is a severe limitation. Undrained areas can provide habitat for wildlife if they are protected from grazing. Shallow ponds provide open water areas for waterfowl and furbearers.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding and the wetness.

The capability subclass is Vw, undrained, and IIIw, drained; Shallow Marsh range site.

Wk—Worthing silt loam, ponded. This deep, very poorly drained, level soil is in depressions in the uplands. It receives runoff from higher lying soils and is ponded most of the year. Areas generally are circular and oblong and range from 5 to 100 acres in size.

Typically, the surface layer is dark gray, mottled silt loam about 10 inches thick. The subsoil is about 30 inches of dark gray and gray, mottled, very firm silty clay. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay loam. In some areas about 5 inches of partly decayed organic matter is at the surface. In other areas the surface layer is sandy loam or loam. The subsoil is sandy clay loam in some places. In other places it has spots and threads of salts. In some areas loamy sand or gravelly sand is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Davison soils. These soils make up less than 5 percent of any one mapped area. They occur as narrow bands around the depressions.

The Worthing soil is high in fertility and in content of organic matter. Available water capacity is moderate or high. Permeability is slow. A perched water table is within a depth of 0.5 foot most of the year. As much as 3 feet of water ponds on the surface during wet periods.

Most areas support native vegetation of rushes, cattails, and other aquatic plants and are used as wildlife habitat. This soil is best suited to wetland wildlife habitat. The aquatic plants provide good habitat for wetland wildlife. Shallow excavations provide open water areas most of the year. The habitat should be protected from grazing.

This soil is unsuited to cultivated crops and to tame pasture and hay, range, windbreaks and environmental plantings, building site development, and sanitary facilities because of the wetness and the ponding. Outlets for artificial drainage systems generally are not available.

The capability subclass is VIIIw; no range site is assigned.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Ralph Stensland, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 72 percent of the acreage in Sanborn County is used for cultivated crops, tame hay, and tame pasture (*3*). The major crops are corn, oats, grain sorghum, spring wheat, barley, and alfalfa. Alfalfa is harvested mainly for hay; corn is harvested for both silage and grain; and oats is grown as a cash crop and as livestock feed.

The potential of the soils in Sanborn County for increased crop production is good. About 65,000 acres of potentially good cropland is currently used as rangeland, 30,000 as pasture, and 40,000 acres as tame hayland. In addition to this reserve productive capacity, food production also could be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion and *soil blowing* are the major problems on almost 47 percent of the cropland in Sanborn County. If the slope is more than 2 percent, erosion is a hazard on the Clarno, Davis, Delmont, Ethan, Hand, Houdek, and other soils.

Erosion reduces productivity and results in sedimentation in streams and lakes. Productivity is reduced when the surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as the Betts, Ethan, and Valentine soils. Erosion also reduces productivity on soils that tend to be droughty, such as the Alwilda, Delmont, and Enet soils. Measures that control erosion minimize the pollution of streams and lakes by sediment and improve water quality for fish and wildlife, recreation, and municipal use.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. In areas where the plant cover does not protect the soil, careful management of crop residue is essential. In the more sloping areas on livestock farms, including legumes and forage crops in the cropping

system helps to control erosion and provides nitrogen and improves the tilth for the next crop.

Slopes are so short and irregular that contour farming or terracing generally is not practical in the more sloping areas of the Clarno and Ethan soils. On these soils a cropping system that provides a good plant cover is needed to help control erosion.

Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion. Together with grassed waterways, these practices are suitable on most of the soils in the survey area.

Terraces and diversions reduce the length of slopes and the runoff rate and help to control erosion. They are most practical on deep, well drained soils that have long, smooth slopes, such as the Davis soils. These soils are well suited to contour farming and contour stripcropping. Many of the other soils in the survey area are less suitable for terraces and diversions because of short, irregular slopes or an unfavorable subsoil, which would be exposed in terrace channels.

Soil blowing is a slight to severe hazard on many of the soils in the county. The hazard is especially severe on the Alwilda, Carthage, Doger, Elsmere, Forestburg, and Valentine soils. The clayey Artesian soils and the soils that have a high content of lime in the surface layer, such as the Davison and Orwet soils, also are highly susceptible. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. An adequate plant cover, a cover of crop residue, and a rough surface help to control soil blowing. Windbreaks of suitable trees and shrubs also are effective in controlling soil blowing.

Information about the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on the poorly drained Clamo, Orwet, Fedora, James, and Tetonka soils. Unless artifically drained, these soils are so wet that crops are frequently damaged. Open ditches help to remove excess water if drainage outlets are available. Controlling runoff on adjacent slopes also reduces the wetness.

Artificial drainage is rarely needed on the moderately well drained Bonilla and Prosper soils in upland swales. These soils receive additional moisture when water runs off higher lying adjacent soils. During wet years tilling and planting are delayed in the spring, but in most years drainage is adequate and the additional moisture is beneficial for most crops.

Soil fertility helps to determine the yields that can be obtained. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The amounts and kinds of fertilizer needed on soils that have a high content of lime in the surface layer, such as the Davison, Fedora, and Orwet soils, generally differ from the amounts and kinds needed on soils that do not have lime in the surface layer. On all soils additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous. Tilth is poor in clayey soils, such as the Artesian and Clamo soils. These soils dry slowly in the spring and are difficult to till when dry. If worked when wet, they tend to become very cloddy when dry. As a result of the cloddiness, preparing a good seedbed is difficult. Timely tillage, grasses and legumes in the cropping system, and crop residue management improve tilth and increase the rate of water intake.

Field crops suited to the soils and climate of the survey area are close-grown crops and row crops. Spring wheat and oats are the main close-grown crops. Barley and rye also are suited but are grown on a lesser acreage. Corn is the main row crop, and sorghum is grown on a considerable acreage. These row crops are harvested for silage and grain.

Vegetable crops, such as muskmelon, pumpkin, squash, and watermelon, are grown on soils having a fine sandy loam or loamy fine sand surface layer. The Blendon, Carthage, Doger, Elsmere, Forestburg, and Woonsocket soils are well suited to these crops. Field windbreaks, stripcropping, and rows of corn alternated with the vegetable crops help to control soil blowing. Some of these crops are irrigated.

The deep, well drained and moderately well drained Bonilla, Clarno, Davis, Hand, Houdek, and Prosper soils are suited to all of the crops commonly grown in the county. The Alwilda and Enet soils are better suited to early maturing small grain than to the deeper rooted crops, such as corn and alfalfa, because the porous underlying material restricts the depth to which roots can penetrate and limits the available water capacity. The Blendon, Carthage, Doger, Elsmere, Forestburg, and Woonsocket soils are better suited to close-grown crops than to row crops because soil blowing is a hazard if these soils are row cropped. Clayey soils, such as Artesian, are better suited to spring wheat and other small grains and alfalfa than to row crops.

Pasture plants best suited to the climate and to most of the soils in the survey area are alfalfa, intermediate wheatgrass, and smooth bromegrass. Crested wheatgrass is well suited to soils that tend to be droughty, such as the Alwilda, Delmont, and Enet soils, and to soils that are high in content of lime, such as the Ethan soils. Bunch-type grasses, such as crested wheatgrass and Russian wildrye, should not be planted alone in areas where the slope is more than 6 percent because erosion is a hazard in these areas.

If the poorly drained and somewhat poorly drained Clamo, Fedora, Hoven, Orwet, Shue, Tetonka, Wann,

and Worthing soils are pastured, the choice of pasture plants is limited to water tolerant species, such as Garrison creeping foxtail and reed canarygrass.

Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition. If the pasture is overgrazed, the more desirable grasses lose vigor and die and are usually replaced by less productive annual grasses and weeds.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*8*). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in

favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

About 33 percent of the acreage of Sanborn County is rangeland. More than half of the farm income is derived from the sale of livestock, principally cattle. Cow-calf-steer enterprises are predominant throughout the county. The average size of farms or ranches is about 680 acres.

The rangeland generally occurs as scattered small tracts throughout the county. These tracts occur as areas of the Betts and Ethan soils near the James River, the Durrstein and Artesian soils near the west- and east-central parts of the county, and the Valentine soils near Forestburg. The soils used as rangeland generally are too steep, too thin, too saline, or too sandy for cultivated crops.

On many farms the forage produced on rangeland is supplemented by crop stubble. In winter the native forage is often supplemented with protein concentrate.

The native plant cover in many parts of the survey area has been greatly depleted by continued overuse. Much of the acreage that was once mixed prairie is now covered with less productive short grasses and weeds. As a result, the amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by applying management that is effective on specific kinds of soil and range sites.

An adequate plant cover and ground mulch help to control erosion and conserve moisture by reducing the runoff rate. If the range is overgrazed, the more desirable tall grasses lose vigor and are replaced by less productive short grasses. Measures that prevent overgrazing improve the range condition. Crossfencing and well distributed watering facilities help to obtain an even distribution of grazing.

native woods and windbreaks and environmental plantings

David L. Hintz, forester, Soil Conservation Service, helped prepare this section.

About 1,800 acres in Sanborn County, or less than 1 percent of the acreage, supports native trees and shrubs. The soils that support the native trees and shrubs are not classified as woodland soils. Most of the trees and shrubs generally grow in areas of rangeland where soil and water relationships are favorable. They are used for watershed protection, recreational purposes, and wildlife food and habitat.

Scattered individual plants or clumps of American elm, American plum, boxelder, bur oak, common chokecherry, common hackberry, false indigo, green ash, peachleaf willow, plains cottonwood, sandbar willow, western

snowberry, and some species of wild rose are common on the Betts, Clamo, Davis, Lamo, and Wann soils. These soils are on the flood plains and breaks near the James River and its main tributaries. Peachleaf willow, plains cottonwood, and sandbar willow are common on the margins of natural lakes and wetlands throughout the county. Russian-olive, an introduced species, is common on all soils.

Windbreaks have been planted since the days of the early settlers. They were planted primarily to protect farmsteads and livestock. Such windbreaks are still needed on thousands of acres in the county. In recent years field windbreaks have been planted to help control soil blowing. Several rows of low- and high-growing broad-leaved and coniferous trees provide the best protection. Controlling weeds and insects helps trees and shrubs to obtain maximum growth. Clean cultivation and applications of herbicide help to control weeds. Fallowing a year before planting helps to provide a reserve of moisture so that seedlings can get a good start. The soils susceptible to soil blowing, such as the Blendon, Carthage, Doger, Forestburg, and Woonsocket soils, should be prepared for planting in the spring so that the site is not exposed during the winter.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

wildlife habitat

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are barley, corn, millet, oats, sunflower, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are alfalfa, bromegrass, clover, fescue, and lovegrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are beggarweed, big and little bluestems, blue grama, goldenrod, switchgrass, and western wheatgrass.

Hardwood trees are planted trees and shrubs that produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are American elm, bur oak, boxelder, hackberry, and green ash. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American plum, common chokecherry, cotoneaster, and Russian-olive.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are inland saltgrass, prairie cordgrass, reeds, rushes, sedges, smartweed, and wild millet.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are level ditches, shallow dugouts, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include cottontail, gray partridge, meadowlark, mourning dove, red fox, and ring-necked pheasant.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are beaver, ducks, geese, herons, mink, muskrat, and shore birds.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include horned lark, jackrabbit, lark bunting, meadowlark, and white-tailed deer.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable

for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 11 gives information about the soils as a source of construction materials. The soils are rated *good, fair, poor,* or *unsuited* as a source of roadfill, sand, gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain

sizes is given in the table on engineering index properties.

A soil rated as a good source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 12 gives information on the soil properties and site features that affect water management. It gives for each soil the restrictive features that affect pond reservoir areas; embankments, dikes, and levees; aquifer-fed excavated ponds; irrigation; terraces and diversions; and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 16.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 16.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in this survey area range from 0.10 to 0.43. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

soil and water features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as

soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering test data

Table 16 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series. The soil samples were analyzed by the South Dakota Department of Transportation, Division of Highways.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*7*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*9*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Alwilda series

The Alwilda series consists of somewhat excessively drained soils that are moderately deep over gravelly sand. Permeability is moderately rapid in the subsoil and rapid in the underlying material. These soils formed in loamy sediments overlying gravelly sand on glacial outwash plains. Slopes range from 0 to 6 percent.

Alwilda soils are similar to Blendon, Doger, and Enet soils and are near Blendon, Carthage, Delmont, Enet, Fedora, and Hand soils. Blendon, Carthage, Doger, and Hand soils are not underlain by gravelly sand. Delmont and Enet soils have a subsoil that is finer textured than that of the Alwilda soils. Fedora soils are poorly drained

and are in the lower lying areas. Blendon, Carthage, Delmont, Enet, and Hand soils are in positions on the landscape similar to those of the Alwilda soils.

Typical pedon of Alwilda fine sandy loam, 0 to 2 percent slopes, 1,250 feet west and 480 feet north of the southeast corner of sec. 31, T. 108 N., R. 61 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

B21—12 to 18 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, very friable; common tongues, black (10YR 2/1) moist; neutral; clear smooth boundary.

B22—18 to 24 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common tongues, black (10YR 2/1) moist; neutral; clear smooth boundary.

B3—24 to 29 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few tongues, black (10YR 2/1) moist; neutral; clear smooth boundary.

IIC1—29 to 46 inches; multicolored gravelly sand; single grain; loose; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC2—46 to 60 inches; multicolored gravelly sand; single grain; loose; strong effervescence; mildly alkaline.

The depth to gravelly sand ranges from 20 to 40 inches. It typically corresponds to the thickness of the solum and the depth to free carbonates.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is sandy loam or fine sandy loam that is 8 to 15 inches thick. It ranges from medium acid to neutral. The B2 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is fine sandy loam or sandy loam and is slightly acid or neutral. Some pedons lack a B3 horizon. The C horizon is gravelly sand or gravelly loamy sand. It has thin lenses of silt loam or very fine sandy loam in some pedons. It is mildly alkaline or moderately alkaline.

Artesian series

The Artesian series consists of deep, moderately well drained soils formed in clayey glaciolacustrine sediments in upland basins. Permeability is slow or very slow. Slopes range from 0 to 2 percent.

Artesian soils are similar to Clamo soils and are near Durrstein, Farmsworth, Lute, Whitelake, and Woonsocket soils. Clamo soils are poorly drained. Durrstein, Farmsworth, Lute, and Whitelake soils have a natric horizon. Woonsocket soils contain less clay and more sand in the subsoil than the Artesian soils. Durrstein soils are in broad drainageways. Farmsworth soils are in positions on the landscape similar to those of the Artesian soils. Lute, Whitelake, and Woonsocket soils are on the slightly higher parts of the landscape.

Typical pedon of Artesian silty clay, in an area of Artesian-Farmsworth complex, 195 feet east and 2,050 feet north of the southwest corner of sec. 34, T. 108 N., R. 62 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate fine granular structure; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

B21—7 to 12 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; slight effervescence; neutral; clear smooth boundary.

B22—12 to 22 inches; dark gray (N 4/0) clay, black (N 2/0) moist; weak medium and coarse prismatic structure parting to moderate medium and fine blocky and subangular blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; strong effervescence; mildly alkaline; clear wavy boundary.

B3ca—22 to 32 inches; dark gray (5Y 4/1) and gray (5Y 5/1) clay, black (5Y 2/1) and very dark gray (5Y 3/1) moist; few fine faint dark gray (5Y 4/1) mottles; weak coarse prismatic structure parting to moderate medium and fine blocky and subangular blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1cs—32 to 41 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; few fine distinct black (5Y 2/1) mottles; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; common fine and medium nests of gypsum; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—41 to 60 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; common fine faint light olive gray 5Y 6/2) mottles; massive; very hard, very firm, sticky and plastic; common dark stains and concretions (iron and manganese oxide); few fine nests of gypsum; common medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum dominantly is 24 to 36 inches but ranges from 24 to 50 inches. The thickness of the mollic epipedon ranges from 20 to 42 inches. The depth to carbonates dominantly is 6 to 12 inches but ranges from 0 to 16 inches. The B horizon averages as low as 45 percent clay in some pedons and as high as 60 percent clay in others. The content of fine sand or coarser sand is less than 15 percent. Few to many nests of gypsum and accumulations of carbonate are in the B3 and C horizons.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is silty clay but in some pedons is clay loam, silty clay loam, or clay. It is 4 to 12 inches thick and ranges from slightly acid to mildly alkaline. The B2 horizon is neutral in hue or has hue of 10YR and 2.5Y and value of 3 to 5 (1 to 3 moist). It is clay or silty clay. The C horizon has hue of 10YR, 2.5Y, or 5Y. It is clay, clay loam, silty clay, or silty clay loam and commonly has strata of coarser material below a depth of 40 inches.

Betts series

The Betts series consists of deep, well drained soils formed in calcareous glacial till on uplands. These soils are moderatly permeable in the upper part and moderately slowly permeable in the lower part of the underlying material. Slopes range from 9 to 40 percent.

Betts soils are similar to Ethan soils and are near Carthage, Clarno, Davis, Ethan, and Forestburg soils. All of the nearby soils have a mollic epipedon. They are less sloping than Betts soils. Also, Carthage and Forestburg soils contain more sand and less clay in the subsoil.

Typical pedon of Betts loam, in an area of Betts-Ethan loams, 9 to 15 percent slopes, 90 feet south and 1,980 feet east of the northwest corner of sec. 31, T. 107 N., R. 62 W.

A1—0 to 5 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; neutral; clear wavy boundary.

AC—5 to 9 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C1ca—9 to 24 inches; light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/3) loam, dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse and medium subangular blocky structure; hard, friable; many fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—24 to 60 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; few fine distinct yellowish brown (10YR 5/6) and few fine faint gray (5Y 5/1) mottles; massive; hard, friable; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline.

The solum is less than 10 inches thick. Some pedons do not have free carbonates in the upper 3 inches. In some pedons the content of stones is, by volume, as much as 20 percent.

The A1 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is 2 to 5 inches thick and is neutral or mildly alkaline. The AC horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is loam or clay loam. Some pedons have a B2 horizon. The C horizon is loam or clay loam. Its mottles are inherited from the parent material.

Blendon series

The Blendon series consists of deep, well drained soils formed in loamy and sandy outwash on uplands. Permeability is moderately rapid in the subsoil and moderately rapid or rapid in the underlying material. Slopes range from 0 to 6 percent.

Blendon soils are similar to Alwilda, Carthage, and Enet soils and are near Alwilda, Carthage, Enet, Fedora, and Hand soils. Alwilda and Enet soils are underlain by gravelly sand. Carthage soils are underlain by loam or silt loam glacial drift at a depth of 20 to 40 inches. Fedora soils are poorly drained and are in the lower lying areas. Hand soils contain more clay and less sand in the subsoil than the Blendon soils. They are in positions on the landscape similar to those of the Blendon soils.

Typical pedon of Blendon fine sandy loam, 0 to 2 percent slopes, 108 feet south and 1,340 feet east of the northwest corner of sec. 28, T. 108 N., R. 60 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—6 to 10 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slightly acid; clear smooth boundary.

B2—10 to 28 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse and medium prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; few tongues, black (10YR 2/1) moist; neutral; gradual smooth boundary.

B3—28 to 34 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

C1—34 to 44 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak coarse

subangular blocky structure parting to single grain; soft, very friable; neutral; clear smooth boundary.

C2—44 to 60 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; single grain; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. The mollic epipedon is more than 24 inches thick.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is sandy loam or loam. It is 10 to 16 inches thick and ranges from medium acid to neutral. The B2 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is fine sandy loam or sandy loam. It is slightly acid in some pedons. Some pedons lack a B3 horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. It ranges from neutral to moderately alkaline. Thin layers of loam, silt loam, clay loam, very fine sandy loam, sand, or gravelly sand are between depths of 40 and 60 inches in some pedons.

Bon series

The Bon series consists of deep, moderately well drained soils formed in alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Bon soils are similar to Bonilla, Davis, Lamo, and Wann soils and are near Betts, Davis, Ethan, and Wann soils. Betts and Ethan soils are on uplands. Betts soils do not have a mollic epipedon, and Ethan soils have a mollic epipedon that is less than 20 inches thick. Bonilla and Davis soils are deeper to carbonates than the Bon soils. Lamo soils contain more silt and less sand than the Bon soils. Wann soils are somewhat poorly drained and are in positions on the landscape similar to those of the Bon soils.

Typical pedon of Bon loam, channeled, 660 feet south and 1,320 feet west of the northeast corner of sec. 23, T. 105 N., R. 60 W.

A11—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

A12—6 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

A13—17 to 26 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

A14—26 to 32 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse and medium subangular blocky structure; slightly hard, friable; few fine threads of salts; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C1—32 to 42 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C2—42 to 60 inches; grayish brown (2.5Y 5/2) fine sandy loam, olive brown (2.5Y 4/3) moist; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; slightly hard, very friable; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 0 to 16 inches. The mollic epipedon is 20 to 40 inches thick. Some pedons have a buried A horizon.

The A horizon dominantly is loam but in some pedons is silt loam. It ranges from 20 to 36 inches in thickness. The C horizon has hue of 10YR, 2.5Y, or 5Y. It is stratified with layers of loam, fine sandy loam, loamy fine sand, silty clay loam, or clay loam.

Bonilla series

The Bonilla series consists of deep, moderately well drained soils formed in loamy alluvium. Permeability is moderate in the subsoil and moderately slow or moderate in the underlying material. These soils are in swales in the uplands. Slopes range from 0 to 6 percent.

Bonilla soils are similar to Bon and Prosper soils and commonly are near Clarno, Davison, Ethan, Hand, and Tetonka soils. Bon soils are shallower to carbonates than the Bonilla soils. Clarno, Ethan, and Hand soils have a mollic epipedon that is less than 20 inches thick. They are on uplands. Davison soils have a calcic horizon. They are in an intermediate position on the landscape between Bonilla and Clarno soils. Prosper soils have an argillic horizon. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Bonilla loam, in an area of Clarno-Bonilla loams, 2 to 6 percent slopes, 84 feet north and 1,950 feet east of the southwest corner of sec. 9, T. 108 N., R. 62 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

B21—8 to 19 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B22—19 to 30 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; coatings in root channels, black (10YR 2/1) moist; gradual wavy boundary.

B3ca—30 to 41 inches; light yellowish brown (2.5Y 6/3) loam, olive brown (2.5Y 4/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; very hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

C1ca—41 to 52 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; few fine distinct gray (5Y 5/1) mottles; weak coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—52 to 60 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 47 inches. The thickness of the mollic epipedon ranges from 20 to 34 inches and corresponds to the depth to free carbonates.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is fine sandy loam or silt loam. It is slightly acid or neutral and is 6 to 10 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is clay loam or loam and ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y. It dominantly is loam or clay loam but is stratified with thin layers of silt loam and fine sandy loam in some pedons. Nests of gypsum crystals are in the lower part of this horizon in some pedons.

Carthage series

The Carthage series consists of deep, moderately well drained soils formed in loamy and sandy outwash sediments overlying glacial drift. Permeability is moderately rapid in the subsoil and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 6 percent.

Carthage soils are similar to Blendon, Forestburg, and Elsmere soils and are near Alwilda, Blendon, Clarno, Fedora, Forestburg, Hand, and Woonsocket soils. Alwilda soils are underlain by gravelly sand. Blendon and Woonsocket soils are not underlain by glacial drift. Also, Woonsocket soils contain more clay in the subsoil than the Carthage soils. Clarno and Hand soils contain less sand and more clay in the subsoil than the Carthage soils. Elsmere soils are somewhat poorly drained. Forestburg soils contain more sand and less clay in the upper part than the Carthage soils. Fedora soils are poorly drained and are on the lower parts of the landscape. All of the other similar or nearby soils are in positions on the landscape similar to those of the Carthage soils.

Typical pedon of Carthage fine sandy loam, in an area of Carthage-Hand fine sandy loams, 2 to 6 percent slopes, 140 feet east and 1,900 feet north of the southwest corner of sec. 25, T. 108 N., R. 62 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—7 to 15 inches; dark grayish brown (10YR 4/2) fine sandy loam, black (10YR 2/1) moist; weak very coarse subangular blocky structure parting to weak fine granular; slightly hard, friable; slightly acid; clear wavy boundary.

B2—15 to 22 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; slightly acid; gradual wavy boundary.

C1—22 to 28 inches; light olive brown (2.5Y 5/4) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; few fine faint very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) mottles; weak coarse subangular blocky structure parting to single grain; slightly hard, loose; neutral; clear wavy boundary.

IIC2ca—28 to 42 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium faint olive gray (5Y 5/2) and few fine distinct yellowish brown (10YR 5/6) and dark reddish brown (5YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few fine concretions (iron and manganese oxide); thin lens of silt loam at about 32 inches; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

IIC3—42 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct strong brown (7.5YR 5/6) and few fine distinct dark reddish brown (5YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; thin lens of fine sand at about 50 inches; few fine dark concretions (iron and manganese oxide); few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches. The thickness of the mollic epipedon and the

depth to carbonates range from 20 to 40 inches. The depth to glacial drift also ranges from 20 to 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is 15 to 20 inches thick. It dominantly is fine sandy loam but in some pedons is loam or sandy loam. It is slightly acid or neutral. The B2 horizon has value of 3 to 5 (3 or 4 moist) and chroma of 1 to 4. It is sandy loam or fine sandy loam and is neutral or slightly acid. The C horizon is clay loam, fine sandy loam, sandy loam, loamy sand, or loamy fine sand. It has few or common, faint or distinct mottles. The IIC horizon is clay loam or loam stratified with thin layers of silt loam to fine sand.

Clamo series

The Clamo series consists of deep, poorly drained soils formed in clayey and silty alluvium on flood plains. Permeability is slow. Slopes range from 0 to 2 percent.

Clamo soils are similar to Artesian soils and commonly are near Davis, Durrstein, James, Lamo, and Wann soils. Artesian soils are moderately well drained and are in upland basins. Davis soils are well drained and are on colluvial foot slopes. Durrstein soils are in broad drainageways, and James, Lamo, and Wann soils are on flood plains. Durrstein and James soils contain more salts than the Clamo soils. Lamo and Wann soils are somewhat poorly drained. Also, Wann soils contain more sand and less clay than the Clamo soils.

Typical pedon of Clamo silty clay, 975 feet west and 1,850 feet north of the southeast corner of sec. 19, T. 107 N., R. 60 W.

A1—0 to 8 inches; dark gray (2.5Y 4/1) silty clay, black (2.5Y 2/1) moist; moderate fine and very fine granular structure; hard, firm, sticky and plastic; slightly acid; clear smooth boundary.

B2g—8 to 14 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; weak coarse and medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, sticky and plastic; slightly acid; clear smooth boundary.

B3gca—14 to 27 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; few fine faint olive gray (5Y 4/2) mottles; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, sticky and plastic; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C1g—27 to 39 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; few fine distinct yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine nests of gypsum; few fine accumulations of carbonate; slight effervescence; neutral; gradual wavy boundary.

C2g—39 to 48 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; common fine distinct yellowish red (5YR 5/6) and olive brown (2.5Y 4/4) and common fine faint gray (5Y 5/1) mottles; massive; very hard, very firm, sticky and plastic; few fine nests of gypsum; few fine concretions (iron and manganese oxide); few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

C3g—48 to 60 inches; light gray (5Y 6/1) silty clay loam, gray (5Y 5/1) moist; many fine distinct yellowish brown (10YR 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; many very fine concretions (iron and manganese oxide); few fine nests of gypsum; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 14 to 20 inches. Some pedons have a buried A horizon below a depth of 36 inches.

The A horizon is neutral in hue or has hue of 2.5Y or 5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1. It dominantly is silty clay but in some pedons is silty clay loam or loam. It ranges from slightly acid to mildly alkaline and is 6 to 12 inches thick. The Bg horizon is silty clay, clay, or silty clay loam. The Cg horizon is stratified with thin layers of sand or silt in some pedons.

Clarno series

The Clarno series consists of deep, well drained and moderately well drained soils formed in glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 9 percent.

Clarno soils are similar to Ethan, Hand, and Houdek soils and are near Bonilla, Dudley, Ethan, Prosper, and Tetonka soils. Bonilla and Prosper soils are in swales. Their mollic epipedon is thicker than that of the Clarno soils. Dudley soils have a natric horizon. Ethan soils are on the slightly higher, more convex parts of the landscape. Their solum is thinner than that of the Clarno soils. Hand soils are more stratified in the underlying material than the Clarno soils. Houdek soils have an argillic horizon. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Clarno loam, in an area of Clarno-Bonilla loams, 2 to 6 percent slopes, 100 feet north and 1,750 feet east of the southwest corner of sec. 9, T. 108 N., R. 62 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky; neutral; abrupt smooth boundary.

B21—6 to 13 inches; olive brown (2.5Y 4/3) clay loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to weak medium

and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few tongues, black (10YR 2/1) moist; neutral; clear wavy boundary.

B22—13 to 18 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; coatings on faces of peds, dark grayish brown (2.5Y 4/2) moist; neutral; clear wavy boundary.

B3ca—18 to 31 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—31 to 41 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—41 to 60 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; common fine distinct yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) and common fine and medium faint olive (5Y 5/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine nests of gypsum; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 42 inches. The depth to free carbonates dominantly is 16 to 18 inches but ranges from 12 to 26 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is fine sandy loam. It is 6 to 12 inches thick and is neutral or slightly acid. The B2 horizon has hue of 2.5Y or 10YR. The B and C horizons are clay loam or loam. The mottles in the C horizon are inherited from the parent material.

Davis series

The Davis series consists of deep, well drained soils formed in local alluvial-colluvial deposits. Permeability is moderate. These soils are on foot slopes, fans, and low terraces along streams. Slopes range from 0 to 6 percent.

Davis soils are similar to Bonilla soils and are near Betts, Clamo, Clarno, Houdek, and Lamo soils. The well drained Betts, Clarno, and Houdek soils are higher on the landscape than the Davis soils. Their mollic epipedon is thinner than that of the Davis soils. Bonilla soils have a subsoil that is more strongly expressed than that of the Davis soils. The poorly drained Clamo and somewhat poorly drained Lamo soils are on flood plains.

Typical pedon of Davis loam, 2 to 6 percent slopes, 260 feet west and 1,400 feet south of the northeast corner of sec. 19, T. 107 N., R. 60 W.

A11—0 to 5 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

A12—5 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear smooth boundary.

B1—10 to 17 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; gradual wavy boundary.

B21—17 to 26 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, friable; neutral; gradual wavy boundary.

B22—26 to 37 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few tongues, black (10YR 2/1) moist; neutral; clear wavy boundary.

B3ca—37 to 44 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—44 to 55 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—55 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 30 to 50 inches. The mollic epipedon is 20 to 55 inches thick.

The A horizon has value of 3 or 4 and chroma of 1 or 2. It is 8 to 18 inches thick. It dominantly is loam, but the range includes silt loam. The B2 horizon has value of 3 to 5 (2 to 4 moist). It is loam, silt loam, or clay loam and is slightly acid or neutral. The C horizon is clay loam, loam, sandy loam, silt loam, or silty clay loam.

Davison series

The Davison series consists of deep, moderately well drained soils formed in loamy glacial drift on uplands. Permeability is moderate. Slopes range from 0 to 3 percent.

Davison soils are similar to Davison Variant and Fedora soils and are near Clarno, Hand, Prosper, Shue, Tetonka, and Worthing soils. Davison Variant soils contain more silt and less sand in the control section than the Davison soils. Fedora soils contain more sand and less clay in the control section than the Davison soils. Clarno, Hand, Prosper, Shue, Tetonka, and Worthing soils do not have a calcic horizon. Clarno and Hand soils are on uplands, Prosper and Shue soils in swales, and Tetonka and Worthing soils in depressions.

Typical pedon of Davison loam, in an area of Tetonka-Davison-Clarno complex, 0 to 2 percent slopes, 147 feet north and 2,300 feet east of the southwest corner of sec. 6, T. 108 N., R. 61 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slight effervescence; neutral; abrupt smooth boundary.

C1ca—8 to 12 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; weak coarse subangular blocky structure; hard, friable; few fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2ca—12 to 28 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; hard, friable; common fine nests of gypsum; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C3cs—28 to 37 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; few fine distinct gray (5Y 5/1) and strong brown (7.5YR 5/6) mottles; massive; hard, friable; common fine nests of gypsum; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C4cs—37 to 60 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; common fine and medium distinct gray (5Y 5/1) and strong brown (7.5YR 5/6) and few fine distinct dark reddish brown (5YR 2/2) mottles; massive; hard, friable; medium threads and nests of gypsum; strong effervescence; mildly alkaline.

The mollic epipedon ranges from 7 to 15 inches in thickness. The calcic horizon is at a depth of 6 to 15 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is neutral to moderately alkaline and is 7 to 12 inches thick. It dominantly is loam, but the range includes silt loam and loamy fine sand. Some pedons have an AC horizon. The Cca horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 3 or 4. It is clay loam or loam and is mildly alkaline or moderately alkaline. The C horizon is stratified loam, sandy loam, silt loam, and clay loam in some pedons. Some pedons have sand below a depth of 40 inches.

Davison Variant

The Davison Variant consists of deep, moderately well drained soils formed in calcareous, silty glaciolacustrine sediments on uplands. Permeability is moderate. Slopes range from 0 to 3 percent.

Davison Variant soils are similar to Davison and Fedora soils and are near Carthage, Elsmere, Forestburg, Hand, Orwet, and Shue soils. Davison and Fedora soils contain more sand and less silt than the Davison Variant soils. Carthage, Elsmere, Forestburg, Hand, and Shue soils are deeper to carbonates than the Davison Variant soils. Carthage, Forestburg, and Hand soils are on the higher parts of the landscape. The somewhat poorly drained Elsmere and Shue and poorly drained Orwet soils are on the lower parts of the landscape.

Typical pedon of Davison Variant silt loam, 212 feet south and 263 feet west of the northeast corner of sec. 36, T. 107 N., R. 62 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

ACca—8 to 16 inches; light yellowish brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly akaline; gradual smooth boundary.

C1ca—16 to 32 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/3) moist; few fine distinct yellowish brown (10YR 5/6) and few fine faint gray (10YR 6/1) mottles; massive; soft, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C2ca—32 to 49 inches; pale yellow (2.5Y 7/3) very fine sandy loam, light olive brown (2.5Y 5/3) moist; common fine and medium distinct dark brown (7.5YR 4/4) and light brownish gray (2.5Y 6/2) mottles; massive; soft, friable; few fine dark stains (iron and manganese oxide); few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C3—49 to 60 inches; pale yellow (2.5Y 7/3) very fine sandy loam, light yellowish brown (2.5Y 6/3) moist; common medium distinct dark brown (7.5YR 4/4) mottles; massive; soft, friable; common fine dark

stains (iron and manganese oxide); few medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 7 to 12 inches. Carbonates typically are at the surface but are leached to a depth of 7 to 10 inches in some pedons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 5 to 10 inches thick. It dominantly is silt loam but in some pedons is very fine sandy loam. It is neutral to moderately alkaline. Some pedons do not have an AC horizon. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 3 or 4. It has strata of fine sandy loam or fine sand in some pedons.

Delmont series

The Delmont series consists of somewhat excessively drained soils that are shallow over gravelly sand. Permeability is moderate or moderately rapid in the subsoil and rapid in the underlying material. These soils are on uplands and stream terraces. Slopes range from 0 to 6 percent.

Delmont soils are similar to Enet soils and are near Alwilda, Carthage, Enet, Fedora, and Hand soils. Alwilda and Carthage soils contain more sand and less clay in the subsoil than the Delmont soils. Enet soils are deeper to gravelly sand than the Delmont soils. Hand soils do not have gravelly sand in the underlying material. Alwilda, Carthage, Enet, and Hand soils are in positions on the landscape similar to those of the Delmont soils. The poorly drained Fedora soils are on the lower parts of the landscape.

Typical pedon of Delmont loam, 0 to 2 percent slopes, 306 feet east and 2,150 feet north of the southwest corner of sec. 17, T. 108 N., R. 62 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; soft, friable; neutral; abrupt smooth boundary.

B21—5 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

B22—10 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few pebbles; neutral; clear wavy boundary.

IIC1ca—14 to 27 inches; grayish brown (10YR 5/2) gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose; gravel coated with carbonates; strong effervescence; mildly alkaline; gradual wavy boundary.

IIC2—27 to 60 inches; brown (10YR 5/3) gravelly sand, brown (10YR 4/3) moist; single grain; loose; strong effervescence; mildly alkaline.

The thickness of the solum, the thickness of the mollic epipedon, and the depth to carbonates range from 10 to 20 inches and correspond to the depth to the gravelly underlying material.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 to 3. It is neutral or mildly alkaline and ranges from 4 to 7 inches in thickness. The B2 horizon has value of 3 to 5. Some pedons have a B3 horizon. The IIC horizon has thin layers of fine sand, loam, or sandy loam in some pedons.

Doger series

The Doger series consists of deep, somewhat excessively drained soils formed in sandy material on uplands. Permeability is rapid. Slopes range from 0 to 6 percent.

Doger soils are similar to Alwilda and Forestburg soils and are near Alwilda, Blendon, Elsmere, Forestburg, Orwet, and Shue soils. Alwilda soils are underlain by gravelly sand. Blendon soils contain more clay and less sand in the subsoil than the Doger soils. Elsmere and Shue soils are somewhat poorly drained and are on the lower parts of the landscape. Forestburg soils have a loamy IIC horizon. Orwet soils are poorly drained and are on the lowest part of the landscape.

Typical pedon of Doger loamy fine sand, 0 to 2 percent slopes, 162 feet south and 1,460 feet west of the northeast corner of sec. 18, T. 107 N., R. 61 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

A12—9 to 14 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak coarse and medium subangular blocky structure; soft, loose; slightly acid; clear wavy boundary.

AC—14 to 23 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure parting to single grain; loose; neutral; clear wavy boundary.

C1—23 to 50 inches; brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; gradual wavy boundary.

C2—50 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grain; loose; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 50 inches. The organic matter content below a depth of 20 inches is less than 1 percent, but the dark colors may extend to a depth of 50 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is 14 to 24 inches thick. The AC horizon has value of 3 to 5 (2 or 3 moist) and chroma of

1 to 3. It is loamy fine sand or fine sand. The C horizon has value of 5 to 7 (4 to 6 moist). It is loamy fine sand, loamy sand, or fine sand.

Dudley series

The Dudley series consists of deep, somewhat poorly drained and moderately well drained soils formed in glacial till on uplands. Permeability is very slow in the subsoil and moderately slow or slow in the underlying material. Slopes range from 0 to 6 percent.

Dudley soils are similar to Farmsworth soils and are near Clarno, Houdek, Hoven, Jerauld, Prosper, Stickney, and Tetonka soils. Clarno, Houdek, Prosper, and Tetonka soils do not have a natric horizon. Also, Hoven and Tetonka soils are poorly drained and are in depressions. Farmsworth soils formed in glaciolacustrine deposits. Jerauld soils are shallower to visible salts than the Dudley soils. Stickney soils do not have columnar structure in the B2t horizon. Clarno, Houdek, Jerauld, and Stickney soils are in positions on the landscape similar to those of the Dudley soils. Prosper soils are in swales.

Typical pedon of Dudley silt loam, in an area of Clarno-Dudley complex, 2 to 6 percent slopes, 1,250 feet east and 1,585 feet south of the northwest corner of sec. 20, T. 107 N., R. 62 W.

A1—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; soft, friable; slightly acid; clear smooth boundary.

A2—6 to 8 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium platy structure parting to weak fine granular; soft, very friable; slightly acid; abrupt smooth boundary.

B21t—8 to 11 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; thin continuous grayish brown (10YR 5/2) coatings on the tops of columnar peds; shiny films on vertical faces of peds; neutral; clear wavy boundary.

B22t—11 to 18 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to strong medium and fine blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B23tcs—18 to 21 inches; dark grayish brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, slightly sticky and slightly plastic; few coatings on vertical faces of peds, very dark gray (10YR 3/1) moist; common fine nests and threads of gypsum; moderately alkaline; clear wavy boundary.

B3cs—21 to 31 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Ccs—31 to 60 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct strong brown (7.5YR 5/6) and few fine and medium faint gray (5Y 5/1) mottles; weak coarse and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine medium nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The solum is 21 to 45 inches thick. The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to free carbonates ranges from 16 to 35 inches.

The A1 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is 4 to 7 inches thick. It dominantly is silt loam, but the range includes loam. The A horizon is neutral or slightly acid. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is 1 to 3 inches thick and is loam or silt loam. It typically is mixed with the A1 horizon in cultivated areas. The B2t horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is clay loam, silty clay, silty clay loam, or clay.

Durrstein series

The Durrstein series consists of deep, poorly drained soils formed in clayey alluvium and glaciolacustrine sediments. Permeability is slow or very slow. These soils are in broad drainageways. Slopes are less than 2 percent.

Durrstein soils are similar to Jerauld and Lute soils and are near Artesian, Clamo, Farmsworth, Hoven, Lute, and Whitelake soils. Artesian and Clamo soils do not have a natric horizon. Farmsworth and Jerauld soils are somewhat poorly drained. Hoven soils are deeper to visible salts than the Durrstein soils. They are in depressions. The moderately well drained Whitelake and somewhat poorly drained Lute soils are on the slightly higher parts of the landscape. Artesian and Farmsworth soils are in broad basins. Clamo soils are on flood plains.

Typical pedon of Durrstein silt loam, 174 feet east and 228 feet south of the northwest corner of sec. 1, T. 107 N., R. 62 W.

A2—0 to 1 inch; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; soft, friable; neutral; abrupt smooth boundary.

B21t—1 to 5 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate medium columnar structure parting to moderate medium subangular

blocky; very hard, very firm, sticky and plastic; moderately alkaline; clear smooth boundary.

B22t—5 to 7 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; few fine threads of salts; moderately alkaline; clear smooth boundary.

B3cs—7 to 12 inches; gray (2.5Y 5/1) clay, very dark gray (5Y 3/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; common fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C1gca—12 to 22 inches; gray (2.5Y 5/1) clay, very dark gray (5Y 3/1) moist; weak medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine nests of gypsum; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—22 to 29 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; few fine faint olive (5Y 4/3) mottles; weak medium blocky structure; very hard, very firm, sticky and plastic; few fine nests of gypsum; few medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C3g—29 to 60 inches; gray (5Y 6/1) silty clay, gray (5Y 5/1) moist; few fine distinct strong brown (7.5YR 5/6) and few fine faint olive (5Y 4/3) mottles; weak medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; thin layer of fine sand at 42 inches; thin layer of black (5Y 2/1) silty clay at 49 inches; common medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 30 inches. The depth to visible salts ranges from 5 to 15 inches.

Some pedons have an A1 horizon, which is less than 2 inches thick. The A2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is loam or silty clay loam. It ranges from 1 to 4 inches in thickness. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is clay or silty clay averaging as low as 45 percent clay in some pedons and as high as 60 percent clay in others. It is mildly alkaline or moderately alkaline. The B3 horizon and the upper part of the C horizon have few to many nests of gypsum and are moderately alkaline or strongly alkaline. The C horizon is clay, silty clay, or clay loam and commonly has strata of coarser material below a depth of 40 inches. A buried horizon is below a depth of 40 inches in some pedons.

Els series

The Els series consists of deep, somewhat poorly drained soils formed in eolian sandy material. Permeability is rapid. These soils are in slight depressions or in nearly level areas on uplands. Slopes range from 0 to 3 percent.

Els soils are similar to Elsmere and Ipage soils and are near Elsmere, Forestburg, Ipage, and Shue soils. Elsmere and Shue soils have a mollic epipedon. Forestburg and Ipage soils are moderately well drained. Forestburg soils are in the slightly higher areas on uplands. Shue soils are on the slightly lower parts of the landscape.

Typical pedon of Els loamy fine sand, in an area of Ipage-Els loamy fine sands, 650 feet north and 590 feet east of the southwest corner of sec. 27, T. 107 N., R. 61 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure parting to single grain; soft, very friable; common fine roots; neutral; clear smooth boundary.

AC—8 to 14 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few tongues, very dark grayish brown (10YR 3/2) moist; neutral; clear smooth boundary.

C1—14 to 26 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; thin layer of very dark brown (10YR 2/2) loamy fine sand at a depth of 15 inches; neutral; clear smooth boundary.

C2—26 to 48 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; neutral; clear smooth boundary.

Ab—48 to 55 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; common medium faint grayish brown (2.5Y 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; slightly hard, very friable; neutral; clear smooth boundary.

C3—55 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; common medium distinct light olive gray (5Y 6/2) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; slightly hard, very friable; few fine accumulations of carbonate; slight effervescence; neutral.

The thickness of the solum ranges from 12 to 18 inches. The soils are neutral or mildly alkaline throughout.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2. It dominantly is loamy fine sand, but

the range includes fine sand. The C horizon has thin layers of gravelly sand to very fine sandy loam between depths of 40 and 60 inches in some pedons.

Elsmere series

The Elsmere series consists of deep, somewhat poorly drained soils formed in sandy material overlying silty and loamy material. Permeability is rapid in the sandy material and moderately slow in the silty and loamy underlying material. These soils are in slight depressions or in nearly level areas on uplands. Slopes range from 0 to 2 percent.

Elsmere soils are similar to Els, Ipage, and Shue soils and are near Doger, Els, Forestburg, Ipage, Orwet, and Shue soils. The somewhat excessively drained Doger and moderately well drained Forestburg soils are on the higher parts of the landscape. Els and Ipage soils do not have a mollic epipedon. Orwet soils are poorly drained and are on the lower parts of the landscape. They have a calcic horizon. Shue soils are loamy at a depth of 20 to 40 inches.

Typical pedon of Elsmere loamy fine sand, loamy substratum, 1,575 feet east and 1,930 feet north of the southwest corner of sec. 28, T. 107 N., R. 61 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A12—6 to 16 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

AC—16 to 25 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse and medium subangular blocky structure; soft, very friable; mildly alkaline; clear wavy boundary.

C1—25 to 33 inches; light brownish gray (2.5Y 6/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; many fine distinct strong brown (7.5YR 5/6) mottles; single grain; loose; few pebbles; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C2—33 to 45 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; many fine distinct strong brown (7.5YR 5/6) mottles; single grain; loose; few pebbles; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

IIC3—45 to 60 inches; light gray (5Y 7/1) stratified silt loam and very fine sandy loam, gray (5Y 5/1) moist; common fine and medium distinct strong brown (7.5YR 5/6) and few medium faint dark gray (5Y 4/1) and very dark gray (5Y 3/1) mottles; massive; soft, friable; few pebbles; common fine dark stains (iron and manganese oxide); strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The thickness of the solum ranges from 16 to 36 inches. In most pedons carbonates are only in the lower part of the profile, but in some pedons they are near the surface.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loamy fine sand but in some pedons is fine sandy loam. It is 10 to 20 inches thick and ranges from slightly acid to mildly alkaline. The C horizon has value of 5 to 7 (4 or 5 moist). It is fine sand or loamy fine sand. The IIC horizon is stratified and ranges from silt loam to gravelly sand.

Enet series

The Enet series consists of well drained soils that are moderately deep over gravelly sand. Permeability is moderate in the subsoil and rapid in the underlying material. These soils are on terraces and uplands. Slopes range from 0 to 6 percent.

Enet soils are similar to Alwilda and Delmont soils and commonly are near Blendon, Delmont, Fedora, and Woonsocket soils. Blendon soils are not underlain by gravelly sand. Delmont soils are shallower to gravelly sand than the Enet soils. Fedora soils are poorly drained and are on the lower parts of the landscape. They have a calcic horizon. The moderately well drained Woonsocket soils have an argillic horizon. Alwilda, Blendon, Delmont, and Woonsocket soils are in positions on the landscape similar to those of the Enet soils.

Typical pedon of Enet loam, 0 to 2 percent slopes, 141 feet south and 222 feet east of the northwest corner of sec. 27, T. 108 N., R. 62 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—5 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear wavy boundary.

B21—8 to 13 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable, slightly sticky; few tongues, black (10YR 2/1) moist; neutral; clear wavy boundary.

B22—13 to 23 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; neutral; clear wavy boundary.

B3—23 to 27 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak

coarse and medium subangular blocky structure; hard, friable; neutral; clear wavy boundary.

IIC1ca—27 to 35 inches; light brownish gray (10YR 6/2) gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; soft, loose; common fine accumulations of carbonate; undersides of gravel coated with carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

IIC2—35 to 50 inches; pale brown (10YR 6/3) gravelly sand, brown (10YR 4/3) moist; single grain; loose; few fine and medium accumulations of carbonate; undersides of gravel coated with carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC3—50 to 60 inches; multicolored gravelly sand; single grain; loose; strong effervescence; moderately alkaline.

The thickness of the solum and of the mollic epipedon ranges from 20 to 40 inches and corresponds to the depth to gravelly sand.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is fine sandy loam. It is 6 to 9 inches thick. The B2 horizon has value of 3 to 5. It is neutral or mildly alkaline and is loam or sandy clay loam.

Ethan series

The Ethan series consists of deep, well drained soils formed in glacial till and loamy glacial melt water deposits. Permeability is moderate in the subsoil and moderately slow in the underlying material. These soils are on uplands. Slopes range from 2 to 15 percent.

Ethan soils are similar to Betts and Clarno soils and are near Betts, Bonilla, Clarno, Forestburg, Hand, and Houdek soils. Betts soils do not have a mollic epipedon. Bonilla soils are in swales. The moderately well drained Forestburg soils are on uplands. Clarno, Hand, and Houdek soils are leached of carbonates to a greater depth than the Ethan soils and generally are less sloping.

Typical pedon of Ethan loam, in an area of Ethan-Clarno loams, 6 to 9 percent slopes, 126 feet south and 1,050 feet west of the northeast corner of sec. 33, T. 108 N., R. 61 W.

A1—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B2—6 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear wavy boundary.

B3ca—9 to 24 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C1ca—24 to 43 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—43 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine distinct yellowish brown (10YR 5/6) and few fine faint light brownish gray (2.5Y 6/2) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 25 inches. The depth to carbonates is 4 to 9 inches in areas of native range, but the soil is calcareous at the surface in some cultivated areas. The mollic epipedon is 7 to 10 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is loam, clay loam, or loamy fine sand. It ranges from slightly acid to mildly alkaline and is 4 to 6 inches thick.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is loam or clay loam that ranges from 18 to 30 percent clay. It ranges from slightly acid to mildly alkaline. Some pedons do not have B2 and B3 horizons but have an AC horizon, which is 8 to 12 inches thick. The B3 horizon is loam, silt loam, or clay loam and is mildly alkaline or moderately alkaline.

The C horizon has hue of 2.5Y or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It typically is clay loam, but in some pedons it is loam and in some it is stratified with silt loam and very fine sandy loam. It ranges from mildly alkaline to strongly alkaline. Accumulations of gypsum are in some pedons. The mottles in the C horizon are inherited from the parent material.

Farmsworth series

The Farmsworth series consists of deep, somewhat poorly drained soils formed in clayey and loamy glaciolacustrine sediments in the upland basins. Permeability is slow or very slow. Slopes are 0 to 2 percent.

Farmsworth soils are similar to Dudley soils and are near Artesian, Durrstein, Fedora, Whitelake, and Woonsocket soils. Artesian, Fedora, and Woonsocket soils do not have a natric horizon. Dudley soils formed in glacial till. Durrstein soils are poorly drained. Whitelake soils are moderately well drained. They contain less clay in the subsoil than the Farmsworth soils. Artesian,

Durrstein, and Fedora soils are in basins or drainageways, and Whitelake and Woonsocket soils are on uplands.

Typical pedon of Farmsworth loam, in an area of Durrstein-Farmsworth complex, 129 feet west and 120 feet north of the southeast corner of sec. 28, T. 108 N., R. 62 W.

A1—0 to 4 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

A2—4 to 6 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

B21—6 to 9 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate medium columnar structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; thin discontinuous coatings of gray (10YR 5/1) on the tops of peds and along vertical faces of peds to a depth of about 8 inches; slightly acid; clear smooth boundary.

B22t—9 to 13 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong medium and fine blocky and subangular blocky; very hard, very firm, sticky and plastic; shiny coatings on vertical faces of peds; neutral; clear smooth boundary.

B23t—13 to 22 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate coarse prismatic structure parting to strong medium and fine blocky and subangular blocky; very hard, very firm, sticky and plastic; shiny coatings on vertical faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

B3cacs—22 to 28 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; few fine distinct olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium nests of gypsum; common fine and medium soft accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1cacs—28 to 53 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine faint very dark gray (10YR 3/1) and common fine distinct olive brown (2.5Y 4/4) mottles; weak coarse subangular blocky structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium nests of gypsum; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2g—53 to 60 inches; light gray (5Y 6/1) and light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) and olive gray (5Y 4/2) moist; common medium faint light gray (5Y 6/1) and very dark gray (5Y 3/1) and common medium distinct pale olive (5Y 6/4) mottles; massive; very hard, firm, sticky and plastic; thin layer of fine sand at a depth of about 58 inches; few fine dark concretions (iron and manganese oxide); common medium accumulations of carbonate; strong effervescence; moderately alkaline.

The solum dominantly is 26 to 36 inches thick but ranges from 24 to 45 inches. The mollic epipedon ranges from 24 to 40 inches in thickness and typically includes all of the B2t horizon. The depth to free carbonates ranges from 12 to 30 inches.

The A1 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is clay loam, silt loam, or silty clay loam. It is slightly acid or neutral and is 3 to 8 inches thick. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is loam, clay loam, silt loam, or silty clay loam.

The B2t horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). It is clay or silty clay that averages as low as 45 percent clay in some pedons and as high as 60 percent clay in others. Few or common, faint or distinct mottles are in the lower part of this horizon in some pedons. Reaction ranges from slightly acid in the upper part to mildly alkaline in the lower part.

The C horizon typically is clay and sandy clay loam, but in some pedons it is silty clay and in some it has strata of coarser material below a depth of 40 inches. The mottles, nests of gypsum, and accumulations of carbonate in the B3 and C horizons range from few to many and from fine to coarse.

Fedora series

The Fedora series consists of deep, poorly drained soils formed in sandy and loamy glacial melt water deposits. Permeability is moderately rapid. These soils are in drainageways and depressions. Slopes range from 0 to 2 percent.

Fedora soils are similar to Davison and Orwet soils and are near Alwilda, Blendon, Carthage, Farmsworth, and Woonsocket soils. Alwilda soils are somewhat excessively drained, Blendon soils well drained, and Carthage and Woonsocket soils moderately well drained. Davison soils contain more clay and less sand between depths of 10 and 40 inches than the Fedora soils. Farmsworth soils are somewhat poorly drained and are in upland basins. Orwet soils contain more sand between depths of 10 and 40 inches than the Fedora soils. None of the nearby soils have a calcic horizon. Alwilda, Blendon, Carthage, and Woonsocket soils are on the slightly higher parts of the landscape.

Typical pedon of Fedora fine sandy loam, 180 feet west and 1,150 feet north of the southeast corner of sec. 36, T. 108 N., R. 62 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—6 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

AC—10 to 15 inches; dark gray (10YR 4/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse and medium subangular blocky structure; slightly hard, very friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C1ca—15 to 30 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) and common medium faint gray (5Y 6/1) mottles; massive; slightly hard, very friable; many fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—30 to 48 inches; light gray (2.5Y 7/2) sandy loam, grayish brown (2.5Y 5/2) moist; many fine and medium distinct very dark grayish brown (10YR 3/2) mottles; single grain; loose; few fine dark concretions (iron and manganese oxide); strong effervescence; moderately alkaline; gradual wavy boundary.

C3—48 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; few medium distinct very dark grayish brown (10YR 3/2) mottles; single grain; loose; strong effervescence; moderately alkaline.

The thickness of the solum and of the mollic epipedon ranges from 7 to 16 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 moist), and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is loam. It is 6 to 10 inches thick and is mildly alkaline or moderately alkaline. The AC horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is loamy sand, sandy loam, or fine sandy loam. Some pedons do not have an AC horizon. The C horizon has hue of 2.5Y or 5Y and value of 6 to 8 (5 to 7 moist). It dominantly is loam to loamy sand, but in some pedons it has layers of silt loam and in some it is gravelly sand between depths of 40 and 60 inches.

Forestburg series

The Forestburg series consists of deep, moderately well drained soils formed in sandy material overlying loamy glacial till. Permeability is rapid in the upper part of the soils and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 9 percent.

Forestburg soils are similar to Carthage and Doger soils and are near Betts, Carthage, Doger, Elsmere, Ethan, and Shue soils. Betts and Ethan soils are well drained and are on the steeper parts of the landscape. Carthage soils contain more clay and less sand in the subsoil than the Forestburg soils. Doger soils are somewhat excessively drained. Elsmere and Shue soils are somewhat poorly drained and are on the lower parts of the landscape.

Typical pedon of Forestburg loamy fine sand, 0 to 2 percent slopes, 96 feet west and 980 feet north of the southeast corner of sec. 11, T. 106 N., R. 61 W.

A11—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine granular structure; loose, very friable; slightly acid; clear smooth boundary.

A12—6 to 19 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; single grain; loose, very friable; slightly acid; clear wavy boundary.

AC—19 to 24 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, very friable; neutral; clear wavy boundary.

C1—24 to 28 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; single grain; soft, very friable; few pebbles; neutral; clear wavy boundary.

IIC2ca—28 to 46 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6), few fine distinct strong brown (7.5YR 5/6), and common fine faint gray (5Y 5/1) mottles; weak coarse and medium subangular blocky structure; hard, friable; many fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC3—46 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) and few fine distinct dark reddish brown (5YR 2/2) mottles; massive; hard, friable, slightly sticky; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches. The mollic epipedon is 10 to 20 inches thick. The organic matter content below a depth of 20 inches is less than 1 percent, but the dark colors may extend to a depth of 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 15 to 20 inches thick. It dominantly is loamy fine sand, but the range includes fine sand and sandy loam. The AC horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 to 3. The C horizon is loamy fine sand or sandy loam. It has free carbonates in some

pedons. Some pedons do not have a C horizon. The IIC horizon dominantly is stratified loam and clay loam, but it has thin layers of very fine sand in some pedons. It is mildly alkaline or moderately alkaline.

Hand series

The Hand series consists of deep, well drained soils formed in stratified loamy melt water deposits on uplands. Permeability is moderate. Slopes range from 0 to 6 percent.

Hand soils are similar to Clarno soils and are near Blendon, Bonilla, Carthage, Clarno, Ethan, Tetonka, and Woonsocket soils. Blendon, Bonilla, Carthage, and Woonsocket soils are on the lower parts of the landscape. They have a mollic epipedon that is more than 20 inches thick. Clarno soils are on uplands. Their underlying material is not so stratified as that of the Hand soils. Ethan soils are on sharply convex slopes. Their solum is thinner than that of the Hand soils. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Hand loam, in an area of Hand-Bonilla loams, 0 to 2 percent slopes, 120 feet north and 1,210 feet west of the southeast corner of sec. 23, T. 107 N., R. 62 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky; netural; abrupt smooth boundary.

B2—9 to 15 inches; light olive brown (2.5Y 5/3) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky; few fine pores; few tongues, very dark gray (10YR 3/1) moist; neutral; clear wavy boundary.

B3ca—15 to 24 inches; light yellowish brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—24 to 31 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/3) moist; weak coarse and medium subangular blocky structure; slightly hard, friable; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C2—31 to 38 inches; pale olive (5Y 6/3) loam, light olive brown (2.5Y 5/3) moist; few fine distinct yellowish brown (10YR 5/6) and few medium faint gray (5Y 5/1) mottles; massive; slightly hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C3—38 to 48 inches; light yellowish brown (2.5Y 6/3) stratified silt loam, loam, and fine sand, light olive brown (2.5Y 5/3) moist; common fine and medium faint gray (5Y 5/1) and common fine and medium distinct yellowish brown (10YR 5/6) mottles; massive; common laminations; slightly hard, very friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

C4—48 to 54 inches; light yellowish brown (2.5Y 6/3) stratified loam and gravelly sand, light olive brown (2.5Y 5/3) moist; common fine and medium faint gray (5Y 5/1) and common fine distinct yellowish brown (10YR 5/6) mottles; massive (loam) and single grain (gravelly sand); slightly hard, very friable (loam) and loose (gravelly sand); slight effervescence; mildly alkaline; clear wavy boundary.

C5—54 to 60 inches; pale olive (5Y 6/3) stratified fine sandy loam and loam, light olive brown (2.5Y 5/3) moist; many fine and medium faint gray (5Y 5/1) and common fine distinct light olive brown (2.5Y 5/6) mottles; massive; common laminations; slightly hard, very friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 36 inches. The depth to free carbonates is 12 to 26 inches. The mollic epipedon ranges from 8 to 20 inches in thickness and extends into the B2 horizon in some pedons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is fine sandy loam, loam, or silt loam and is medium acid to neutral. It is 6 to 10 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is loam or silt loam and is neutral or slightly acid. The B3ca horizon is loam, clay loam, or silty clay loam. The C horizon dominantly is stratified silt loam, loam, very fine sandy loam, and fine sandy loam, but some pedons have thin layers of loamy very fine sand, fine sand, gravelly sand, and clay loam.

Houdek series

The Houdek series consists of deep, well drained soils formed in glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Houdek soils are similar to Clarno soils and are near Dudley, Ethan, Hoven, Prosper, Stickney, and Tetonka soils. Clarno and Ethan soils do not have an argillic horizon. Dudley, Hoven, and Stickney soils have a natric horizon. Prosper soils are moderately well drained and Tetonka soils poorly drained. Dudley, Prosper, and Stickney soils are in plane areas and swales. Ethan soils are on the slightly higher convex parts of the landscape. Hoven and Tetonka soils are in depressions.

Typical pedon of Houdek loam, in an area of Houdek-Stickney loams, 0 to 2 percent slopes, 378 feet east and 760 feet north of the southwest corner of sec. 6, T. 105 N., R. 59 W.

A1—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B21t—8 to 12 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few tongues, black (10YR 2/1) moist; neutral; clear wavy boundary.

B22t—12 to 17 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; few tongues, black (10YR 2/1) moist; neutral; clear wavy boundary.

B3ca—17 to 27 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1ca—27 to 39 inches; pale yellow (2.5Y 7/3) clay loam, light olive brown (2.5Y 5/4) moist; few fine distinct strong brown (7.5YR 5/6) and few fine faint gray (5Y 5/1) mottles; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—39 to 60 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct strong brown (7.5YR 5/6), few fine distinct dark reddish brown (5YR 2/2), and common fine faint gray (5Y 5/1) mottles; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 36 inches. The depth to free carbonates ranges from 14 to 24 inches. The mollic epipedon is 8 to 20 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is 5 to 8 inches thick. It dominantly is loam but in some pedons is silt loam. It is slightly acid or neutral. The B2t horizon has hue of 10YR or 2.5Y and value of 4 or 5 (2 to 4 moist). It is neutral or mildly alkaline. It averages as low as 27 percent clay in some pedons and as high as 35 percent clay in others. Some pedons, however, have thin horizons in which the clay content is more than 35 percent. The B3ca horizon is clay loam or loam and is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. Accumulations of gypsum are in some pedons. The mottles are inherited from the parent material.

Hoven series

The Hoven series consists of deep, poorly drained soils formed in alluvium in depressions. Permeability is very slow. Slopes are less than 1 percent.

Hoven soils are near Dudley, Durrstein, Houdek, Jerauld, Prosper, and Stickney soils. Durrstein soils are shallower to salts than the Hoven soils and have a thinner solum. Houdek and Prosper soils contain less clay in the subsoil than the Hoven soils. They do not have a natric horizon. The somewhat poorly drained Dudley and Jerauld, the well drained Houdek, and the moderately well drained Stickney soils are on the slightly higher parts of the landscape. Durrstein and Prosper soils are in swales and drainageways.

Typical pedon of Hoven silt loam, 183 feet south and 2,490 feet east of the northwest corner of sec. 34, T. 107 N., R. 62 W.

A2—0 to 3 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

B21t—3 to 9 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; gray (10YR 6/1) coatings on the tops of columns; strong medium columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; neutral; clear wavy boundary.

B22t—9 to 24 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate coarse and medium prismatic structure parting to strong medium and fine blocky; extremely hard, very firm, sticky and plastic; common fine nests of gypsum; neutral; gradual wavy boundary.

B3—24 to 31 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; many fine and medium faint dark gray (5Y 4/1) and common fine distinct dark yellowish brown (10YR 4/6) and dark reddish brown (5YR 2/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; common fine and medium nests of gypsum; few coatings on vertical faces of peds, black (10YR 2/1) moist; few fine accumulations of carbonate; mildly alkaline; gradual wavy boundary.

C1g—31 to 43 inches; gray (5Y 6/1) clay loam, dark gray (5Y 4/1) moist; common fine distinct dark yellowish brown (10YR 4/6) and dark reddish brown (5YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; common fine nests of gypsum; few fine accumulations of carbonate; mildly alkaline; clear wavy boundary.

C2g—43 to 60 inches; light gray (5Y 7/1) clay loam, gray (5Y 5/1) moist; common medium distinct yellowish

brown (10YR 5/6) and common fine distinct dark reddish brown (5YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few fine nests of gypsum; few fine dark concretions (iron and manganese oxide); few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The solum ranges from 20 to 42 inches in thickness. It is medium acid to neutral in the upper part and mildly alkaline to strongly alkaline in the lower part.

Some pedons have an A1 horizon, which is 1 to 4 inches thick. The A2 horizon has value of 5 to 7 (2 to 4 moist) and chroma of 1 or 2. It is 1 to 4 inches thick. It dominantly is silt loam, but silty clay loam is within the range. Few or common, faint or distinct mottles are in this horizon in some pedons. The B2t horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is clay loam, silty clay, or clay. It does not have accumulations of gypsum in some pedons. The C horizon typically is clay loam, but in some pedons it is clay, silty clay, or silty clay loam and in some thin strata of coarser textured material are below a depth of 40 inches.

Ipage series

The Ipage series consists of deep, moderately well drained soils formed in eolian sandy material on uplands. Permeability is rapid. Slopes range from 0 to 3 percent.

Ipage soils are similar to Els and Elsmere soils and commonly are near Els, Elsmere, Orwet, and Valentine soils. Els and Elsmere soils are somewhat poorly drained, and Orwet soils are poorly drained and are on the lower parts of the landscape. Also, Elsmere and Orwet soils have a mollic epipedon. Valentine soils are excessively drained and are on the higher parts of the landscape.

Typical pedon of Ipage loamy fine sand, in an area of Ipage-Els loamy fine sands, 470 feet north and 625 feet east of the southwest corner of sec. 27, T. 107 N., R. 61 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

AC—6 to 9 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, loose; slightly acid; clear wavy boundary.

C1—9 to 26 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grain; soft, loose; neutral; gradual wavy boundary.

C2—26 to 46 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; common fine and medium distinct dark yellowish brown (10YR 3/4) mottles; single grain; soft, loose; slightly acid; gradual wavy boundary.

Ab—46 to 60 inches; gray (10YR 5/1) loamy sand, dark gray (10YR 4/1) moist; many fine and medium dark yellowish brown (10YR 3/4) mottles; single grain; slightly hard, very friable; neutral.

The thickness of the solum ranges from 6 to 16 inches. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 to 6 (3 or 4 moist). It is 3 to 10 inches thick. It dominantly is loamy fine sand, but loamy sand and fine sand are within the range. The C horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 or 3. It is fine sand, sand, or loamy sand. Some pedons do not have a buried A horizon.

James series

The James series consists of deep, poorly drained soils formed in silty and clayey alluvium on flood plains. Permeability is slow. Slopes are less than 1 percent.

James soils are near Clamo, Durrstein, and Lamo soils. Clamo and Lamo soils do not have visible salts in the solum. Durrstein soils have a natric horizon. All of the nearby soils are in positions on the landscape similar to those of the James soils.

Typical pedon of James silty clay, 2,340 feet north and 650 feet east of the southwest corner of sec. 12, T. 105 N., R. 60 W.

A11—0 to 2 inches; very dark gray (2.5Y 3/1) silty clay, black (2.5Y 2/1) moist; weak fine granular structure; hard, very firm, sticky and plastic; few fine spots of salts; slight effervescence; mildly alkaline; clear smooth boundary.

A12gsa—2 to 10 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; weak fine and medium subangular blocky structure; hard, very firm, sticky and plastic; many fine threads and spots of salts; strong effervescence; mildly alkaline; clear wavy boundary.

B2gsa—10 to 20 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; common medium faint dark gray (5Y 4/1) mottles; weak coarse and medium subangular blocky structure parting to moderate fine and very fine subangular blocky; hard, firm, sticky and plastic; many fine threads and spots of salts; few nests of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

B3gcasa—20 to 32 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; common medium faint dark gray (5Y 4/1) and few fine distinct strong brown (7.5YR 5/6) and dark reddish brown (5YR 2/2) mottles; weak coarse subangular blocky structure parting to weak fine subangular blocky; hard, firm, slightly sticky and slightly plastic; many fine threads and spots of salts; few medium nests of gypsum; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1gcacs—32 to 50 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; common medium faint

very dark gray (5Y 3/1) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium nests of gypsum; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

A1bg—50 to 60 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; massive; very hard, very firm, sticky and plastic; few fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 36 inches. The mollic epipedon ranges from 24 to 60 or more inches in thickness. Carbonates are within 10 inches of the surface. The electrical conductivity ranges from about 8 to 20 millimhos per centimeter in the upper part of the profile. In some pedons the buried A horizon is at a depth of 20 to 40 inches.

The A horizon ranges from mildly alkaline to strongly alkaline. It dominantly is silty clay but in some pedons is silty clay loam. It is 8 to 14 inches thick. The B2g horizon has hue of 5Y or 2.5Y and value of 2 to 4 (2 or 3 moist). It is moderately alkaline or strongly alkaline. Some pedons do not have a B3g horizon. The C horizon has hue of 2.5Y or 5Y and value of 4 to 6 (2 to 4 moist). It is mildly alkaline or moderately alkaline. Some pedons have thin strata of loam and sandy loam between depths of 40 and 60 inches.

Jerauld series

The Jerauld series consists of deep, somewhat poorly drained soils formed in glacial drift on uplands. Permeability is slow or very slow. Slopes range from 0 to 2 percent.

Jerauld soils are near Clarno, Dudley, Houdek, Hoven, and Stickney soils. Clarno and Houdek soils do not have a natric horizon. They are on the slightly higher parts of the landscape. Dudley and Stickney soils do not have visible salts within a depth of 16 inches. They are in positions on the landscape similar to those of the Jerauld soils. Hoven soils are poorly drained and are in depressions.

Typical pedon of Jerauld silt loam, in an area of Dudley-Jerauld-Clarno complex, 0 to 2 percent slopes, 300 feet west and 169 feet north of the southeast corner of sec. 18, T. 107 N., R. 62 W.

A1—0 to 2 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, friable; neutral; clear smooth boundary.

A2—2 to 5 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slightly acid; abrupt smooth boundary.

B2t—5 to 11 inches; dark gray (10YR 4/1) silty clay, very dark brown (10YR 2/2) moist; thin discontinuous gray (10YR 6/1) coatings on the tops of columns; strong medium and fine columnar structure parting to strong medium and fine subangular blocky; very hard, very firm, sticky and plastic; neutral; clear wavy boundary.

B3cs—11 to 17 inches; brown (10YR 5/3) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; many fine nests of gypsum; many fine threads and spots of salts; few fine accumulations of carbonate; moderately alkaline; gradual wavy boundary.

C1csca—17 to 38 inches; pale yellow (2.5Y 7/3) silty clay, light olive brown (2.5Y 5/3) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium nests of gypsum; common fine spots of salts; few tongues, very dark grayish brown (10YR 3/2) moist; strong effervescence; moderately alkaline; gradual wavy boundary.

C2cs—38 to 54 inches; pale yellow (2.5Y 7/3) silty clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct gray (5Y 6/1) and dark yellowish brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; common fine and medium nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—54 to 60 inches; pale yellow (2.5Y 7/3) silty clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 20 inches. The depth to carbonates ranges from 6 to 20 inches and the depth to accumulations of gypsum from 7 to 16 inches.

Some pedons do not have an A1 horizon. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is silt loam, loam, or silty clay loam and is 1 to 3 inches thick. It ranges from medium acid to neutral. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is clay or silty clay that ranges from 35 to 60 percent clay. It ranges from neutral to moderately alkaline. The B3 horizon has common to many accumulations of gypsum and few to common accumulations of carbonate. The C horizon is clay loam, silty clay loam, or silty clay. It ranges from mildly alkaline to strongly alkaline.

Lamo series

The Lamo series consists of deep, somewhat poorly drained soils formed in silty alluvium on flood plains.

Permeability is moderately slow. Slopes range from 0 to 2 percent.

Lamo soils are near Clamo, James, and Wann soils on flood plains. Clamo and James soils contain more clay and Wann soils less clay than the Lamo soils. Also, James soils have visible salts near the surface.

Typical pedon of Lamo silty clay loam, in an area of Wann-Lamo complex, 676 feet north and 415 feet east of the center of sec. 15, T. 108 N., R. 61 W.

A11—0 to 5 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

A12—5 to 9 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

A13—9 to 17 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine distinct dark brown (7.5YR 4/4) mottles; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear wavy boundary.

AC—17 to 32 inches; gray (2.5Y 5/1) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C—32 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; many fine distinct dark brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure parting to weak medium platy; hard, friable, slightly sticky and slightly plastic; thin layer of fine sand at about 48 inches; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 24 to 35 inches. Carbonates are at the surface in some pedons.

The A horizon is 12 to 18 inches thick. It dominantly is silty clay loam, but the range includes silt loam. In some pedons the upper part is slightly lighter colored because of overwash. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2.

Lute series

The Lute series consists of deep, somewhat poorly drained and poorly drained soils formed in sandy and loamy alluvium in broad basins. Permeability is slow in the subsoil and moderate or moderately rapid in the underlying material. Slopes are less than 2 percent.

Lute soils are near Durrstein, Elsmere, Orwet, and Whitelake soils. Durrstein soils contain more clay in the subsoil than the Lute soils. Elsmere and Orwet soils do not have a natric horizon. Whitelake soils are moderately well drained. Durrstein and Orwet soils are in positions on the landscape similar to those of the Lute soils. Elsmere and Whitelake soils are on the slightly higher parts of the landscape.

Typical pedon of Lute fine sandy loam, 910 feet north and 510 feet west of the southeast corner of sec. 31, T. 107 N., R. 61 W.

A2—0 to 2 inches; gray (10YR 5/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

B21t—2 to 4 inches; dark gray (10YR 4/1) sandy clay loam, very dark grayish brown (10YR 3/2) moist; black (10YR 2/1) coatings on faces of peds; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, firm, slightly sticky and slightly plastic; few medium accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

B22t—4 to 7 inches; grayish brown (2.5Y 5/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct strong brown (7.5YR 5/6) and few fine faint dark gray (5Y 4/1) mottles; weak coarse prismatic structure parting to moderate medium blocky; extremely hard, firm, sticky and plastic; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

B3—7 to 16 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; common fine distinct black (5Y 2/1), common fine and medium faint dark gray (5Y 4/1), and few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse and medium blocky; very hard, friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—16 to 30 inches; light gray (2.5Y 7/2) loamy fine sand, light brownish gray (2.5Y 6/2) moist; common fine distinct pale olive (5Y 6/4) and light olive brown (2.5Y 5/6) and common medium faint gray (5Y 5/1) mottles; massive; hard, very friable; few fine dark concretions; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; many medium distinct olive brown (2.5Y 4/4), common fine distinct strong brown (7.5YR 5/6), and common medium faint dark gray (5Y 4/1) mottles; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 9 to 20 inches. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is loamy fine sand. It is 1 to 3 inches thick. The B2t horizon has value of 4 to 6 (2 to 5 moist) and chroma of 1 to 4. It is sandy clay loam or fine sandy loam that averages as low as 18 percent clay in some pedons and as high as 25 percent clay in others. The C horizon typically is loamy fine sand, but in some pedons it is fine sand and in some it has strata of finer textured material.

Orwet series

The Orwet series consists of deep, poorly drained soils formed in sandy and loamy sediments in drainageways and depressions. Permeability is rapid. Slopes range from 0 to 2 percent.

Orwet soils commonly are near Doger, Els, Elsmere, Ipage, and Shue soils. These nearby soils do not have a calcic horizon. The somewhat excessively drained Doger, the somewhat poorly drained Els and Elsmere, and the moderately well drained Ipage soils are on the slightly higher parts of the landscape. The somewhat poorly drained Shue soils are in positions on the landscape similar to those of the Orwet soils.

Typical pedon of Orwet fine sandy loam, 550 feet west and 1,550 feet south of the northeast corner of sec. 28, T. 107 N., R. 61 W.

Apca—0 to 6 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12ca—6 to 11 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; slightly hard, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

AC—11 to 21 inches; gray (10YR 6/1) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; slight effervescence; moderately alkaline; gradual wavy boundary.

C1—21 to 33 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—33 to 56 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; many fine and medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; slight effervescence; moderately alkaline; gradual wavy boundary.

Ab—56 to 60 inches; very dark gray (10YR 3/1) loamy fine sand, black (10YR 2/1) moist; many fine and medium faint very dark brown (10YR 2/2) mottles; single grain; loose; slight effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1. It ranges from 10 to 20 inches in thickness. It dominantly is fine sandy loam and loamy fine sand, but the range includes loam and sandy loam. The AC horizon has distinct yellowish brown mottles in some pedons. The C horizon typically is fine sand, but in some pedons it is loamy fine sand or sand and in some it has thin layers of silt loam, loam, silty clay loam, or very fine sandy loam.

Prosper series

The Prosper series consists of deep, moderately well drained soils formed in glacial till in swales on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 2 percent.

Prosper soils are similar to Bonilla and Woonsocket soils and are near Clarno, Dudley, Houdek, Hoven, Stickney, and Tetonka soils. Clarno and Houdek soils are well drained and are on the slightly higher parts of the landscape. Dudley, Hoven, and Stickney soils have a natric horizon. Dudley, Bonilla, and Stickney soils are in positions on the landscape similar to those of the Prosper soils. Hoven and Tetonka soils are poorly drained and are in depressions. Woonsocket soils contain more sand in the subsoil than the Prosper soils. They are on the slightly higher parts of the landscape.

Typical pedon of Prosper loam, in an area of Clarno-Prosper loams, 0 to 2 percent slopes, 450 feet south and 905 feet west of the northeast corner of sec. 12, T. 108 N., R. 62 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A12—7 to 11 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear wavy boundary.

B21t—11 to 20 inches; dark gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) moist; black (10YR 2/1) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium and fine blocky; hard. firm, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.

B22t—20 to 24 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; very dark brown (10YR 2/2) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium and fine blocky; hard, firm, sticky and plastic; shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B3ca—24 to 30 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; shiny films on faces of peds; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—30 to 40 inches; light gray (2.5Y 7/2) loam, light yellowish brown (2.5Y 6/3) moist; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; slightly hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 49 inches; light gray (2.5Y 7/2) clay loam, light yellowish brown (2.5Y 6/3) moist; common fine distinct yellowish brown (10YR 5/6), common fine faint gray (5Y 5/1), and few fine distinct black (5YR 2/1) mottles; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine nests of gypsum; few fine dark concretions (iron and manganese oxide); few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C3—49 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct yellowish brown (10YR 5/6), common fine faint gray (5Y 5/1), and few fine distinct black (5Y 2/1) mottles; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine nests of gypsum; few fine dark concretions (iron and manganese oxide); few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 40 inches. The depth to free carbonates ranges from 20 to 36 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. It is slightly acid or neutral and is 7 to 12 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 to 3. It averages as low as 27 percent clay in some pedons and as high as 35 percent clay in others. Some pedons, however, have thin horizons in which the clay content is more than 35 percent. The B3ca and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. They are mildly alkaline or moderately alkaline.

Shue series

The Shue series consists of deep, somewhat poorly drained soils formed in sandy eolian or outwash material overlying loamy glacial till. Permeability is rapid in the upper part of the soils and moderately slow in the underlying material. These soils are in swales or shallow depressions in the uplands. Slopes range from 0 to 2 percent.

Shue soils are similar to Elsmere soils and are near Carthage, Davison, Doger, Elsmere, Forestburg, Orwet, and Shue Variant soils. Carthage and Forestburg soils are moderately well drained. Elsmere soils do not have loamy underlying material at a depth of 20 to 40 inches. Orwet soils have a calcic horizon. Carthage, Doger, Elsmere, and Forestburg soils are on the higher parts of the landscape. The moderately well drained Davison and poorly drained Orwet and Shue Variant soils are in positions on the landscape similar to those of the Shue soils.

Typical pedon of Shue loamy fine sand, in an area of Shue-Davison loamy fine sands, 138 feet east and 1,750 feet south of the northwest corner of sec. 13, T. 106 N., R. 61 W.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.

A12—7 to 15 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; neutral; clear smooth boundary.

C1—15 to 29 inches; light olive brown (2.5Y 5/3) loamy fine sand, olive brown (2.5Y 4/3) moist; many fine and medium distinct dark yellowish brown (10YR 3/4) and common fine distinct strong brown (7.5YR 5/6) and very dark brown (10YR 2/2 mottles; weak coarse subangular blocky structure parting to single grain; slightly hard, very friable; few pebbles; few fine dark concretions (iron and manganese oxide); neutral; clear wavy boundary.

IIC2g—29 to 34 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; many fine distinct yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; common fine concretions (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

IIC3gca—34 to 60 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) and few fine faint olive (5Y 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine dark concretions (iron and manganese oxide); many fine and medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 10 to 20 inches. The depth to contrasting loamy material ranges from 20 to 40 inches. The mollic epipedon is 10 to 16 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loamy fine sand but in some pedons is sandy loam. It is 10 to 16 inches thick and is neutral or mildly alkaline. Some pedons have an AC horizon, which is 3 to 8 inches thick.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is loamy fine sand or fine sand and is neutral or mildly alkaline. In some pedons it has free carbonates. The IIC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It typically is clay loam and loam, but in some pedons it is silt loam or silty clay loam and in some it has thin layers of coarser textured material. It is mildly or moderately alkaline. Common accumulations of gypsum are in some pedons.

Shue Variant

The Shue Variant consists of deep, poorly drained soils formed in sandy eolian or outwash material overlying silty drift and loamy glacial till. Permeability is rapid in the upper part of the soils and moderately slow in the underlying material. These soils are in depressions and drainageways. Slopes range from 0 to 2 percent.

Shue Variant soils are near Doger, Elsmere, Forestburg, Orwet, and Shue soils. Doger soils are somewhat excessively drained, Elsmere and Shue soils somewhat poorly drained, and Forestburg soils moderately well drained. Orwet soils have a calcic horizon. Doger, Elsmere, and Forestburg soils are on the slightly higher parts of the landscape. Orwet and Shue soils are in positions on the landscape similar to those of the Shue Variant soils.

Typical pedon of Shue Variant loamy fine sand, 132 feet west and 490 feet south of the northeast corner of sec. 21, T. 106 N., R. 61 W.

A11—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; many fine distinct dark brown (7.5YR 4/4) mottles; weak fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; many fine distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—12 to 17 inches; grayish brown (2.5Y 5/2) loamy fine sand, very dark grayish brown (2.5Y 3/2) moist; common fine distinct dark brown (7.5YR 4/4) and few medium faint dark gray (5Y 4/1) mottles; weak coarse and medium subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C1—17 to 25 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; common fine distinct strong brown (7.5YR 5/6), few fine distinct black (5YR 2/1), and few fine faint dark gray (5Y 4/1) mottles; weak coarse subangular blocky structure; slightly hard, very friable; mildly alkaline; gradual wavy boundary.

C2—25 to 36 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; many medium distinct strong brown (7.5YR 5/6) and few fine and medium faint black (5YR 2/1) and dark gray (5Y 4/1) mottles; weak coarse subangular blocky structure; slightly hard, very friable; mildly alkaline; clear wavy boundary.

IIA13b—36 to 46 inches; dark gray (5Y 4/1) silt loam, black (5Y 2/1) moist; moderate medium subangular blocky structure; hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

IIC3g—46 to 60 inches; light gray (5Y 7/1) silty clay loam, gray (5Y 6/1) moist; common medium distinct light yellowish brown (2.5Y 6/4) and common medium faint dark gray (5Y 4/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine nests of gypsum crystals; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 10 to 20 inches. The depth to contrasting loamy material ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 10 to 24 inches. The depth to carbonates typically corresponds to the depth to contrasting loamy material, but some pedons are calcareous in the C horizon.

The A horizon has value of 3 or 4 (2 or 3 moist). It is 10 to 20 inches thick. It dominantly is loamy fine sand but in some pedons is fine sandy loam. It is neutral or mildly alkaline. Some pedons do not have an AC horizon. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is loamy fine sand, fine sand, or loamy sand. The buried A horizon of contrasting loamy material ranges from 4 to 15 inches in thickness. It does not occur in some pedons. The buried A horizon and the IIC horizon generally range from silt loam to silty clay loam, but thin lenses of coarser textured material are in some pedons.

Stickney series

The Stickney series consists of deep, moderately well drained soils formed in glacial till on uplands. Permeability is slow. Slopes range from 0 to 2 percent.

Stickney soils are near Dudley, Houdek, Jerauld, Prosper, and Tetonka soils. Dudley and Jerauld soils have columnar structure in the B21t horizon. Houdek, Prosper, and Tetonka soils do not have a natric horizon. Also, Houdek soils are well drained and Tetonka soils poorly drained. Dudley, Houdek, and Jerauld soils are in positions on the landscape similar to those of the Stickney soils. Hoven soils are in depressions, and Prosper soils are in swales.

Typical pedon of Stickney loam, in an area of Houdek-Stickney loams, 0 to 2 percent slopes, 120 feet north and 1,190 feet east of the southwest corner of sec. 17, T. 105 N., R. 60 W.

A11—0 to 2 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

A12—2 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure; hard, friable; neutral; clear smooth boundary.

A2—7 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable; neutral; abrupt smooth boundary.

B&A—10 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam (B), black (10YR 2/1) moist, and light brownish gray (10YR 6/2) silt loam (A), very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky; neutral; clear wavy boundary.

B21t—12 to 17 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak medium prismatic structure parting to strong fine and medium blocky; very hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B22t—17 to 26 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B23tcs—26 to 31 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; very hard, firm, sticky and plastic; common medium and fine nests of gypsum; slight effervescence; mildly alkaline; gradual wavy boundary.

B3cs—31 to 36 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; few tongues, black (10YR 2/1) moist; many fine nests of gypsum; slight effervescence; mildly alkaline; gradual wavy boundary.

C1csca—36 to 52 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; common fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—52 to 60 inches; pale yellow (2.5Y 7/3) clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct yellowish brown (10YR 5/6), common fine faint gray (5Y 5/1), and few fine distinct dark reddish brown (5YR 2/2) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum, the depth to carbonates, and the thickness of the mollic epipedon range from 20 to 40 inches. Gypsum is at a depth of 20 to 30 inches.

The A1 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam or silty clay loam. It is 6 to 8 inches thick and is medium acid to neutral. The A2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 to 3. It is silt loam, loam, or silty clay loam and is slightly acid or neutral. The B2t horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 or 2. It is slightly acid to mildly alkaline. The C horizon has hue of 2.5Y or 5Y. It is clay loam or loam.

Tetonka series

The Tetonka series consists of deep, poorly drained soils formed in local alluvium overlying glacial drift. Permeability is very slow. These soils are in closed depressions and broad swales. Slopes are less than 1 percent.

Tetonka soils are similar to Worthing soils and are near Clarno, Davison, Hand, Houdek, Prosper, and Stickney soils. Clarno, Hand, and Houdek soils are well drained and Davison and Prosper soils moderately well drained. Stickney soils have a natric horizon. Clarno, Davison, Hand, Houdek, and Stickney soils are on the higher parts of the landscape, and Prosper soils are in swales. Worthing soils do not have an A2 horizon.

Typical pedon of Tetonka silt loam, 126 feet north and 750 feet west of the southeast corner of sec. 19, T. 108 N., R. 62 W.

Ap—0 to 8 inches; gray (10YR 5/1) silt loam, black (10YR 2/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A2—8 to 13 inches; light gray (10YR 7/1) silt loam, gray (10YR 5/1) moist; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; slightly hard, friable; neutral; clear wavy boundary.

A&B—13 to 16 inches; light gray (10YR 7/1) silt loam (A2), gray (10YR 5/1) moist, and dark gray (10YR 4/1) silty clay (B2t), black (10YR 2/1) moist; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; slightly acid; clear smooth boundary.

B21t—16 to 20 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, very

firm, sticky and plastic; few tongues, gray (10YR 5/1) moist; few fine dark concretions (iron and manganese oxide); slightly acid; gradual wavy boundary.

B22t—20 to 42 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine faint very dark gray (10YR 3/1) mottles; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; extremely hard, very firm, sticky and plastic; neutral; gradual wavy boundary.

B3—42 to 49 inches; gray (5Y 5/1) and light olive gray (5Y 6/2) silty clay, very dark gray (10YR 3/1) and olive gray (5Y 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4) and common fine faint olive (5Y 5/3) mottles; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine dark concretions (iron and manganese oxide); mildly alkaline; gradual wavy boundary.

Cca—49 to 60 inches; light gray (5Y 7/1) clay loam, olive gray (5Y 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4) and dark reddish brown (5YR 2/2) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 60 inches. The depth to free carbonates ranges from 36 to 60 inches or more.

The Ap or A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 6 to 12 inches thick. It dominantly is silt loam, but the range includes silty clay loam. The A2 horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 or 2. It is loam, silt loam, or silty clay loam. Some pedons do not have an A&B horizon. The B2t horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It is silty clay, clay, or clay loam. Carbonates are in the B3 horizon in some pedons. The C horizon typically is clay loam, but in some pedons it is clay or silty clay and in some it has thin strata of loam or sandy loam between depths of 40 and 60 inches.

Tetonka Variant

The Tetonka Variant consists of deep, poorly drained soils formed in local alluvium over sandy glacial outwash. Permeability is slow in the subsoil and rapid in the underlying material. These soils are in depressions. Slopes are less than 2 percent.

Tetonka Variant soils are similar to Tetonka soils and are near Blendon, Carthage, Fedora, and Woonsocket soils. Blendon soils are well drained, and Carthage and Woonsocket soils are moderately well drained. Fedora soils have a calcic horizon. Tetonka soils contain more clay in the subsoil than the Tetonka Variant soils. All of the nearby soils are higher on the landscape than the Tetonka Variant soils.

Typical pedon of Tetonka Variant fine sandy loam, 285 feet south and 1,020 feet east of the northwest corner of sec. 28, T. 108 N., R. 62 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; medium acid; clear wavy boundary.

A12—5 to 9 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

A21—9 to 15 inches; gray (10YR 5/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak coarse and medium subangular blocky structure parting to weak medium platy; slightly hard, friable; slightly acid; clear wavy boundary.

A22—15 to 19 inches; gray (10YR 6/1) loamy fine sand, dark grayish brown (10YR 4/2) moist; common fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure parting to weak medium and thin platy; soft, very friable; slightly acid; clear smooth boundary.

B21t—19 to 27 inches; gray (10YR 5/1) sandy clay loam, very dark gray (10YR 3/1) moist; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and slightly plastic; many fine dark concretions (iron and manganese oxide); neutral; gradual wavy boundary.

B22t—27 to 34 inches; grayish brown (2.5Y 5/2) sandy clay loam, very dark grayish brown (2.5Y 3/2) moist; common fine distinct yellowish brown (10YR 5/6) and few coarse faint grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); neutral; gradual wavy boundary.

C1—34 to 42 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; common fine distinct yellowish brown (10YR 5/6) and few coarse faint olive gray (5Y 5/2) mottles; weak coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine concretions (iron and manganese oxide); neutral; clear smooth boundary.

C2—42 to 60 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose; neutral.

The thickness of the solum dominantly is about 25 to 35 inches but ranges from 22 to 50 inches. The depth to carbonates ranges from 20 to 60 inches.

The Ap or A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It has few or common, faint or distinct mottles in some pedons. It dominantly is fine

sandy loam but in some pedons is loam or sandy clay loam. It is 6 to 16 inches thick and ranges from medium acid to neutral. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is fine sandy loam, sandy loam, loamy fine sand, or loamy sand. It is 4 to 10 inches thick and ranges from medium acid to neutral. An A&B horizon is in some pedons.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is sandy clay loam or fine sandy loam. It is slightly acid or neutral. Few or common, faint or distinct mottles are in most pedons.

The C horizon typically is fine sandy loam and fine sand, but in some pedons it is sandy clay loam, sandy loam, loamy fine sand, loamy sand, or sand and in some it has thin strata of gravelly sand.

Valentine series

The Valentine series consists of deep, excessively drained soils formed in eolian sand on uplands. Permeability is rapid. Slopes range from 3 to 15 percent.

Valentine soils are near Doger, Els, Elsmere, Forestburg, Ipage, and Shue soils. Doger soils have a mollic epipedon. Els, Elsmere, and Shue soils are somewhat poorly drained, and Forestburg and Ipage soils are moderately well drained. The nearby soils generally are less sloping than the Valentine soils.

Typical pedon of Valentine fine sand, 3 to 15 percent slopes, 610 feet east and 300 feet north of the southwest corner of sec. 19, T. 107 N., R. 60 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure parting to single grain; loose; neutral; clear smooth boundary.

AC—5 to 13 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grain; loose; neutral; gradual smooth boundary.

C—13 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

The thickness of the solum ranges from 5 to 17 inches. The soils are slightly acid or neutral throughout.

The A horizon has value of 4 to 6 (3 to 5 moist). It is 2 to 9 inches thick. It dominantly is fine sand, but the range includes loamy fine sand. The AC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is fine sand or loamy fine sand. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4. Dark buried horizons of loamy fine sand are between depths of 20 and 60 inches in some pedons.

Wann series

The Wann series consists of deep, somewhat poorly drained soils formed in alluvium on flood plains. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Wann soils are similar to Bon soils and are near Blendon, Clamo, Doger, Durrstein, and Lamo soils. The well drained Blendon and somewhat excessively drained Doger soils are on uplands. Bon soils are moderately well drained. Clamo soils contain more clay and less sand than the Wann soils. The poorly drained Durrstein soils have a natric horizon. Lamo soils contain more silt and less sand than the Wann soils. Clamo, Durrstein, and Lamo soils are in positions on the landscape similar to those of the Wann soils.

Typical pedon of Wann loam, in an area of Wann-Lamo complex, 172 feet north and 2,475 feet west of the southeast corner of sec. 22, T. 107 N., R. 61 W.

A11—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; strong effervescence; neutral; clear smooth boundary.

A12—6 to 13 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slight effervescence; neutral; clear smooth boundary.

AC—13 to 17 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse and medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C1—17 to 42 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct brown (7.5YR 5/4) and common fine faint dark reddish brown (5YR 2/2) mottles; weak coarse subangular blocky structure; slightly hard, friable; thin lens of silt loam and loam; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—42 to 60 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; common fine distinct brown (7.5YR 5/4) mottles; single grain; loose; thin lens of loam; mildly alkaline.

The thickness of the solum ranges from 12 to 20 inches and is the same as the thickness of the mollic epipedon.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is fine sandy loam or loamy sand. It is 11 to 20 inches thick and is neutral or mildly alkaline. Some pedons do not have an AC horizon. The C horizon has hue of 10YR or 2.5Y and value of 5 to 7 (4 to 6 moist). It is mildly alkaline or moderately alkaline.

The mollic epipedon in the map unit Wann fine sandy loam is thicker than is defined as the range for the Wann series. This difference, however, does not alter the use or behavior of the soil.

Whitelake series

The Whitelake series consists of deep, moderately well drained soils formed in loamy outwash sediments on uplands. Permeability is slow in the subsoil and moderate or moderately rapid in the underlying material. Slopes range from 0 to 6 percent.

Whitelake soils are near Blendon, Doger, Elsmere, Lute, Shue, and Woonsocket soils. Blendon, Doger, Elsmere, Shue, and Woonsocket soils do not have a natric horizon. Lute soils are somewhat poorly drained. Blendon and Doger soils are on the slightly higher parts of the landscape. Elsmere, Lute, and Woonsocket soils are in positions on the landscape similar to those of the Whitelake soils. Shue soils are in slight depressions.

Typical pedon of Whitelake fine sandy loam, in an area of Whitelake-Woonsocket fine sandy loams, 2 to 6 percent slopes, 550 feet south and 1,900 feet west of the northeast corner of sec. 24, T. 107 N., R. 62 W.

A1—0 to 8 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; medium acid; clear wavy boundary.

A2—8 to 12 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak coarse and medium subangular blocky structure; slightly hard, very friable; neutral; clear wavy boundary.

B21t—12 to 15 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; thin coatings of gray (10YR 5/1) on the tops of columns; strong medium columnar structure; extremely hard, firm, sticky and plastic; shiny coatings on vertical faces of peds; mildly alkaline; clear wavy boundary.

B22tsa—15 to 19 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong medium blocky; very hard, firm, sticky and plastic; common fine threads of salts; shiny coatings on vertical faces of peds; mildly alkaline; clear wavy boundary.

B3cs—19 to 27 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; very hard, friable, slightly sticky and slightly plastic; common fine and medium nests of gypsum; shiny coatings on vertical faces of peds; moderately alkaline; gradual wavy boundary.

C1—27 to 32 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky; few fine and medium nests of gypsum; moderately alkaline; gradual wavy boundary.

C2—32 to 35 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; moderately alkaline; clear wavy boundary.

C3—35 to 60 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; common medium faint dark gray (5Y 4/1) and common fine distinct dark brown (7.5YR 3/2) mottles; massive; slightly hard, friable; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 40 inches. The depth to free carbonates ranges from 10 to 35 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A1 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is 8 to 16 inches thick. It dominantly is fine sandy loam but in some pedons is sandy loam or loamy fine sand. It ranges from medium acid to mildly alkaline. The A2 horizon is 2 to 4 inches thick. It is loamy fine sand, fine sandy loam, or sandy loam. The B2t horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It ranges from mildly alkaline to strongly alkaline. It is fine sandy loam or sandy clay loam. The B3 horizon is sandy clay loam, fine sandy loam, sandy loam, loamy fine sand, or loamy sand. Thin strata of clay and silt are in the C horizon in some pedons.

Woonsocket series

The Woonsocket series consists of deep, moderately well drained soils formed in loamy and sandy sediments on glacial outwash plains. Permeability is moderate in the solum and moderately rapid or rapid in the underlying material. Slopes range from 0 to 6 percent.

Woonsocket soils are similar to Prosper soils and are near Blendon, Carthage, Fedora, and Whitelake soils. Blendon and Carthage soils do not have an argillic horizon. Fedora soils have a calcic horizon. Prosper soils contain less sand in the subsoil than the Woonsocket soils. Whitelake soils have a natric horizon. Blendon, Carthage, and Whitelake soils are in positions on the landscape similar to those of the Woonsocket soils. Fedora soils are in the slightly lower lying areas.

Typical pedon of Woonsocket fine sandy loam, 2,400 feet north and 240 feet east of the southwest corner of sec. 35, T. 108 N., R. 62 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, b1ack (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

B1—8 to 12 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable; slightly acid; clear smooth boundary.

B21t—12 to 19 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm,

slightly sticky and slightly plastic; shiny films on vertical faces of peds; slightly acid; clear smooth boundary.

B22t—19 to 24 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; faces of peds are very dark gray (10YR 3/1) moist; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, firm, sticky and plastic; shiny films on vertical faces of peds; slightly acid; clear wavy boundary.

B3—24 to 28 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct black (10YR 2/1), yellowish brown (10YR 5/6), and dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine dark concretions (iron and manganese oxide); few pebbles; few tongues, very dark gray (10YR 3/1) moist; few fine accumulations of carbonate; neutral; clear wavy boundary.

C1ca—28 to 42 inches; light brownish gray (2.5Y 6/2) loamy fine sand, light olive brown (2.5Y 5/3) moist; common fine distinct black (10YR 2/1) and yellowish brown (10YR 5/6) and common medium faint grayish brown (2.5Y 5/2) mottles; weak coarse subangular blocky structure parting to single grain; soft, very friable; few pebbles; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—42 to 60 inches; brown (10YR 5/3) fine sand, dark yellowish brown (10YR 3/4) moist; single grain; loose; strong effervescence; mildly alkaline.

The thickness of the solum dominantly is 22 to 28 inches but ranges from 15 to 32 inches. The mollic epipedon ranges from 20 to 35 inches in thickness and commonly includes all of the B2t horizon. The depth to free carbonates ranges from 14 to 32 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is sandy loam. It is 6 to 12 inches thick and is slightly acid or neutral. Some pedons do not have a B1 horizon. The B2t horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It typically is sandy clay loam but in some pedons is sandy loam or fine sandy loam. It is slightly acid or neutral. Some pedons do not have a B3 horizon. The C horizon typically is loamy fine sand and fine sand, but in some pedons it is loamy sand or sand and in some it has thin strata of loam, silt loam, or fine sandy loam below a depth of 40 inches.

Worthing series

The Worthing series consists of deep, poorly drained and very poorly drained soils formed in local clayey and loamy alluvial sediments in depressions in the uplands. Permeability is slow. Slopes are less than 1 percent.

Worthing soils are similar to Tetonka soils and are near Blendon, Bonilla, Clarno, Davison, Ethan, and Houdek soils. Blendon, Clarno, Ethan, and Houdek soils are well drained and are on the higher parts of the landscape. Bonilla and Davison soils are moderately well drained. Bonilla soils are in swales. Davison soils are in slightly convex areas adjacent to depressions. The have a calcic horizon. Tetonka soils have a light gray A2 horizon.

Typical pedon of Worthing silt loam, 240 feet north and 1,820 feet west of the southeast corner of sec. 1, T. 105 N., R. 59 W.

A1—0 to 10 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; slightly hard, friable, slightly sticky; neutral; clear wavy boundary.

B21t—10 to 18 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium and fine blocky; very hard, very firm, sticky and plastic; slightly acid; gradual wavy boundary.

B22t—18 to 35 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to strong medium and fine blocky; very hard, very firm, sticky and plastic; neutral; gradual wavy boundary.

B3g—35 to 40 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; few fine accumulations of carbonate; mildly alkaline; gradual wavy boundary.

Cgca—40 to 60 inches; gray (5Y 6/1) clay loam, dark gray (5Y 4/1) moist; many fine and medium strong brown (7.5YR 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; common fine dark concretions (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 38 to 50 inches. The depth to free carbonates ranges from 35 to 60 inches.

The A horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1. It dominantly is silt loam but in some pedons is silty clay loam. It is 8 to 15 inches thick and is medium acid to neutral. The B2t horizon has hue of 10YR, 2.5Y, or 5Y and value of 3 to 5 (2 or 3 moist). It is clay or silty clay that averages as low as 40 percent clay in some pedons

and as high as 55 percent clay in others. It is slightly acid or neutral. In some pedons the lower part of this horizon has accumulations of gypsum. The B3g and C horizons are silty clay, silty clay loam, or clay loam. They are mildly alkaline or moderately alkaline. They have few to common gypsum crystals in some pedons.

factors of soil formation

Soil forms when chemical and physical processes act on geologically deposited or accumulated material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Sanborn County.

climate

Climate directly influences the rate of chemical and physical weathering. Sanborn County has a continental climate marked by cold winters and hot summers. The average annual air temperature is about 46 degrees F. The average annual precipitation is about 21 inches, of which about 70 percent falls during the period April through September.

This climate favors a grassland ecology. As a result of the grass cover, organic matter accumulates in the upper part of the soil. The precipitation is sufficient to leach carbonates in most soils to an average depth of about 20 inches. The climate is generally uniform throughout the county and thus as a separate factor does not differentiate the soils within the county. Additional climatic data are given in the section "General nature of the county."

plant and animal life

Living organisms play an important part in soil formation. These include plants, animals, insects, earthworms, bacteria, and fungi. In Sanborn County the tall and mid prairie grasses have had more influence on soil formation than other living organisms. As a result of these grasses, the surface layer of many soils has a moderate or high content of organic matter. Bonilla soils are an example.

Earthworms, cicadas, and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose plant residue, thus releasing nutrients that plants use as food.

parent material

Most of the soils in Sanborn County formed in glacial material that was derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. The glacier ground up and mixed these materials as it transported them. It then redeposited them as it melted. Some deposits are unsorted material or glacial till; others are material sorted either by water during deposition or by wind and water after deposition.

Glacial deposits of Late Wisconsin age average 35 feet in thickness over older glacial deposits in most areas of the county. The Late Wisconsin ice margin probably melted four times during the period of deglaciation. The Late Wisconsin deposits are mainly poorly sorted glacial till, stratified loamy glacial drift, and stratified glacial outwash.

The glacial till weathers to light olive brown or grayish brown, friable or firm loam and clay loam. Betts, Clarno, Ethan, and Houdek soils formed in glacial till.

Stratified loamy glacial drift mantles the unsorted till in much of the west-central part of the county. Hand soils formed partly or entirely in this stratified drift.

Glacial outwash is sand, gravel, and loamy material deposited by melt water. Delmont and Enet soils formed in loamy material underlain by sand and gravel within a depth of 40 inches. The outwash deposits occur as a thin mantle over glacial till or glacial drift in extensive areas. Carthage, Forestburg, and Shue soils formed in outwash sediments underlain by glacial till or drift within a depth of 40 inches. Blendon soils are in areas where outwash sediments are more than 40 inches thick. Doger and Valentine soils are in areas where outwash sand has been reworked and redesposited by wind.

Glaciolacustrine deposits are in the east-central part of the county. Artesian and Farmsworth soils formed in these clayey sediments.

Bonilla, Hoven, Prosper, and Tetonka soils formed partly or entirely in local alluvium washed in from adjacent sloping soils in the uplands. Clamo, Durrstein, Lamo, and Wann soils formed in alluvium deposited by streams.

relief

Relief affects drainage, runoff, erosion, plant cover, and soil temperature. Betts are examples of soils that lose much rainfall because of excessive runoff. As a result of the excessive runoff, less moisture enters the soil and more soil is lost through erosion. These soils are calcareous at or near the surface. The layers in which organic matter accumulates are thin.

The runoff rate is slower on Clarno, Hand, and Houdek soils than on the Betts soils. As a result, more moisture enters the soil and the layers in which organic matter accumulates are thicker. Also, these soils are calcareous at a depth of more than 10 inches.

Bonilla and Prosper soils are in swales that receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter accumulates are thicker than those in the Clarno, Hand, and Houdek soils. Also, carbonates are leached to a greater depth.

Drainage is impeded in some low areas. The high, fluctuating water table in the soils in these areas favors the concentration of salts. Durrstein and James soils are examples.

time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that have formed. All of the soils in Sanborn County are relatively young, dating back to the Late Wisconsin glacial period. The youngest soils are those on active flood plains, such as Bon, Lamo, and Wann soils.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compact layers to depths below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Crop residue management. Using that part of the plant or crop left in the field after harvest for protection or improvement of the soil.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are

shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the

solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH

7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently referred to as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils

are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-74 at Forestburg, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	24.7	2.8	13.8	53	-28	0	0.48	0.10	0.77	1	4.6
February---	31.7	9.7	20.7	60	-25	12	.76	.21	1.19	2	7.2
March------	41.4	19.9	30.7	73	-12	97	1.16	.34	1.80	3	8.3
April------	59.3	34.0	46.7	89	13	228	2.17	1.11	3.03	5	2.7
May--------	70.8	45.5	58.2	93	25	564	3.19	1.46	4.60	6	.2
June-------	80.3	56.0	68.2	101	38	846	3.34	1.99	4.53	6	.0
July-------	86.7	60.6	73.7	104	45	1,045	2.93	1.58	4.02	5	.0
August-----	85.9	58.7	72.3	103	43	1,001	2.40	1.00	3.53	4	.0
September--	75.3	47.8	61.6	99	27	648	1.76	.66	2.64	4	.0
October----	64.4	37.5	51.0	90	16	357	1.67	.29	2.72	3	.9
November---	45.3	22.7	34.0	73	-5	38	.86	.16	1.40	2	3.4
December---	30.6	10.2	20.4	59	-23	15	.73	.19	1.16	2	6.4
Yearly:											
Average--	58.0	33.8	45.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	106	-30	---	---	---	---	---	---
Total----	---	---	---	---	---	4,851	21.45	17.38	25.32	43	33.7

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-74 at Forestburg, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 3	May 17	May 22
2 years in 10 later than--	April 28	May 11	May 18
5 years in 10 later than--	April 17	April 28	May 11
First freezing temperature in fall:			
1 year in 10 earlier than--	October 2	September 24	September 15
2 years in 10 earlier than--	October 7	September 29	September 21
5 years in 10 earlier than--	October 17	October 9	September 30

TABLE 3.--GROWING SEASON LENGTH

[Data were recorded in the period 1951-74 at Forestburg, South Dakota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	162	140	125
8 years in 10	169	148	131
5 years in 10	182	164	142
2 years in 10	195	179	153
1 year in 10	202	187	159

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AaA	Alwilda fine sandy loam, 0 to 2 percent slopes	2,430	0.7
AaB	Alwilda fine sandy loam, 2 to 6 percent slopes	3,095	0.8
Ab	Artesian-Farmsworth complex	3,085	0.8
BaE	Betts loam, 15 to 40 percent slopes	5,080	1.4
BbD	Betts-Ethan loams, 9 to 15 percent slopes	1,600	0.4
BcA	Blendon fine sandy loam, 0 to 2 percent slopes	2,065	0.6
BcB	Blendon fine sandy loam, 2 to 6 percent slopes	840	0.2
Bd	Bon loam, channeled	1,780	0.5
CaA	Carthage fine sandy loam, 0 to 2 percent slopes	2,960	0.8
CaB	Carthage fine sandy loam, 2 to 6 percent slopes	3,005	0.8
CbA	Carthage-Clarno fine sandy loams, 0 to 2 percent slopes	8,640	2.4
CcB	Carthage-Hand fine sandy loams, 2 to 6 percent slopes	15,025	4.1
Cd	Clamo loam	780	0.2
Ce	Clamo silty clay	5,310	1.5
Cf	Clamo silty clay, frequently flooded	935	0.3
CgA	Clarno loam, 0 to 2 percent slopes	4,835	1.3
ChB	Clarno-Bonilla loams, 2 to 6 percent slopes	26,670	7.3
CkB	Clarno-Dudley complex, 2 to 6 percent slopes	7,580	2.1
CmB	Clarno-Ethan loams, 2 to 6 percent slopes	26,570	7.3
CoA	Clarno-Prosper loams, 0 to 2 percent slopes	31,880	8.7
DaB	Davis loam, 2 to 6 percent slopes	1,005	0.3
Db	Davison loam	1,105	0.3
Dc	Davison Variant silt loam	645	0.2
DdA	Delmont loam, 0 to 2 percent slopes	615	0.2
DeA	Doger loamy fine sand, 0 to 2 percent slopes	2,225	0.6
DeB	Doger loamy fine sand, 2 to 6 percent slopes	775	0.2
DfA	Dudley-Jerauld-Clarno complex, 0 to 2 percent slopes	3,600	1.0
Dh	Durrstein silt loam	14,090	3.9
Dk	Durrstein-Farmsworth complex	2,685	0.7
Ea	Elsmere loamy fine sand, loamy substratum	6,470	1.8
Eb	Elsmere-Orwet complex	1,420	0.4
EcA	Enet loam, 0 to 2 percent slopes	780	0.2
EdB	Enet-Delmont loams, 2 to 6 percent slopes	3,240	0.9
EeC	Ethan-Clarno loams, 6 to 9 percent slopes	11,385	3.1
Fa	Fedora fine sandy loam	3,100	0.8
FbA	Forestburg loamy fine sand, 0 to 2 percent slopes	3,280	0.9
FcB	Forestburg-Ethan loamy fine sands, 2 to 6 percent slopes	5,815	1.6
FcC	Forestburg-Ethan loamy fine sands, 6 to 9 percent slopes	610	0.2
HaA	Hand-Bonilla loams, 0 to 2 percent slopes	2,045	0.6
HbB	Hand-Ethan loams, 2 to 6 percent slopes	13,090	3.6
HcB	Houdek-Dudley complex, 2 to 6 percent slopes	9,325	2.6
HdB	Houdek-Ethan loams, 2 to 6 percent slopes	4,975	1.4
HeA	Houdek-Prosper loams, 0 to 2 percent slopes	11,100	3.0
HeB	Houdek-Prosper loams, 2 to 6 percent slopes	5,095	1.4
HfA	Houdek-Stickney loams, 0 to 2 percent slopes	24,000	6.6
Hk	Hoven silt loam	2,765	0.8
HmA	Hoven-Durrstein silt loams, 0 to 2 percent slopes	1,360	0.4
Ia	Ipage-Els loamy fine sands	1,370	0.4
Ja	James silty clay	900	0.2
La	Lamo silty clay loam	825	0.2
Lb	Lute fine sandy loam	1,810	0.4
Lc	Lute fine sandy loam, ponded	715	0.2
LdA	Lute-Whitelake fine sandy loams, 0 to 2 percent slopes	1,060	0.3
Oa	Orwet fine sandy loam	1,480	0.4
Pa	Pits, gravel	230	0.1
Sa	Shue-Davison loamy fine sands	7,310	2.0
Sb	Shue Variant loamy fine sand	1,755	0.5
Ta	Tetonka loamy fine sand, overblown	1,525	0.4
Tb	Tetonka silt loam	20,910	5.7
TcA	Tetonka-Davison-Clarno complex, 0 to 2 percent slopes	13,620	3.7
Td	Tetonka Variant fine sandy loam	1,165	0.3
VaC	Valentine fine sand, 3 to 15 percent slopes	390	0.1
Wa	Wann fine sandy loam	1,385	0.4
Wb	Wann-Lamo complex	1,960	0.5
WcB	Whitelake-Woonsocket fine sandy loams, 2 to 6 percent slopes	590	0.1
Wd	Woonsocket fine sandy loam	5,045	1.4
We	Worthing silt loam	2,305	0.6
Wk	Worthing silt loam, ponded	7,440	2.0
	Water	885	0.2
	Total	365,440	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Oats	Grain sorghum	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*
AaA---------- Alwilda	42	48	40	1.7	2.9
AaB---------- Alwilda	40	46	38	1.5	2.4
Ab---------- Artesian-Farmsworth	---	46	43	2.4	3.8
BcA---------- Blendon	50	50	46	2.0	3.2
BcB---------- Blendon	48	48	45	1.9	3.0
CaA---------- Carthage	62	51	55	2.8	4.5
CaB---------- Carthage	57	48	52	2.6	4.2
CbA---------- Carthage-Clarno	61	55	54	2.8	4.5
CcB---------- Carthage-Hand	60	53	52	2.6	4.2
Cd---------- Clamo	56	55	50	2.8	4.5
Ce---------- Clamo	53	51	46	2.8	4.5
CgA---------- Clarno	60	67	58	2.9	4.6
ChB---------- Clarno-Bonilla	61	67	60	2.9	4.6
CkB---------- Clarno-Dudley	46	51	45	2.2	3.5
CmB---------- Clarno-Ethan	54	59	52	2.5	4.0
CoA---------- Clarno-Prosper	62	69	61	2.9	4.6
DaB---------- Davis	60	72	59	2.9	4.6
Db---------- Davison	51	59	45	2.4	3.8
Dc---------- Davison Variant	51	62	46	2.5	4.0
DdA---------- Delmont	24	32	22	1.2	1.9
DeA, DeB---------- Doger	30	32	38	1.8	2.9

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Grain sorghum	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*
Dk---------- Durrstein-Farmsworth	---	---	---	1.4	2.2
Ea---------- Elsmere	60	40	50	3.0	4.8
Eb---------- Elsmere-Orwet	56	36	48	3.0	4.8
EcA---------- Enet	43	49	39	2.0	3.2
EdB---------- Enet-Delmont	33	39	33	1.7	2.7
EeC---------- Ethan-Clarno	44	49	40	2.2	3.5
Fa---------- Fedora	40	42	40	2.5	4.0
FbA---------- Forestburg	58	46	45	2.6	4.2
FcB---------- Forestburg-Ethan	51	46	42	2.3	3.7
FcC---------- Forestburg-Ethan	---	---	---	2.1	3.4
HaA---------- Hand-Bonilla	66	69	60	2.6	4.2
HbB---------- Hand-Ethan	59	60	50	2.4	3.8
HcB---------- Houdek-Dudley	48	54	48	2.1	3.4
HdB---------- Houdek-Ethan	55	61	49	2.4	3.8
HeA---------- Houdek-Prosper	65	69	59	2.8	4.5
HeB---------- Houdek-Prosper	62	66	57	2.6	4.2
HfA---------- Houdek-Stickney	58	63	55	2.7	4.3
Ja---------- James	---	32	---	2.4	3.8
La---------- Lamo	70	66	68	3.2	5.1
LdA---------- Lute-Whitelake	---	---	---	1.0	1.6
Sa---------- Shue-Davison	53	51	50	2.8	4.5

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Grain sorghum	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*
Ta**---------- Tetonka	48	30	45	2.7	4.3
Tb**---------- Tetonka	51	51	45	2.7	4.3
TcA---------- Tetonka-Davison-Clarno	53	57	51	2.6	4.2
Td---------- Tetonka Variant	51	51	---	2.7	4.3
Wa---------- Wann	55	55	60	3.5	5.6
Wb---------- Wann-Lamo	59	62	65	3.3	5.3
WcB---------- Whitelake-Woonsocket	43	43	52	1.6	2.6
Wd---------- Woonsocket	60	54	56	2.1	3.4
We**---------- Worthing	55	59	45	2.8	4.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** Yields are for drained areas only.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
AaA, AaB Alwilda	Sandy	Favorable	3,100	Little bluestem	25
		Normal	2,600	Needleandthread	15
		Unfavorable	1,800	Prairie sandreed	15
				Porcupinegrass	10
				Big bluestem	10
				Blue grama	10
				Leadplant	5
				Sedge	5
Ab*:					
Artesian	Clayey	Favorable	4,800	Big bluestem	35
		Normal	4,000	Western wheatgrass	25
		Unfavorable	2,800	Switchgrass	15
				Sedge	10
				Indiangrass	10
Farmsworth	Claypan	Favorable	2,900	Western wheatgrass	50
		Normal	2,400	Blue grama	15
		Unfavorable	1,700	Green needlegrass	10
				Sedge	10
				Buffalograss	5
BaE Betts	Thin Upland	Favorable	2,800	Little bluestem	40
		Normal	2,300	Sideoats grama	15
		Unfavorable	1,600	Needleandthread	10
				Blue grama	10
				Prairie dropseed	10
				Sedge	5
				Leadplant	5
BbD*:					
Betts	Thin Upland	Favorable	2,800	Little bluestem	40
		Normal	2,300	Sideoats grama	15
		Unfavorable	1,600	Needleandthread	10
				Blue grama	10
				Prairie dropseed	10
				Sedge	5
				Leadplant	5
Ethan	Silty	Favorable	2,900	Needlegrass	40
		Normal	2,400	Western wheatgrass	20
		Unfavorable	1,700	Little bluestem	10
				Sideoats grama	10
				Big bluestem	5
				Blue grama	5
				Sedge	5
BcA, BcB Blendon	Sandy	Favorable	3,500	Little bluestem	35
		Normal	2,900	Prairie sandreed	15
		Unfavorable	2,000	Big bluestem	10
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
Bd Bon	Overflow	Favorable	4,700	Big bluestem	55
		Normal	4,300	Western wheatgrass	15
		Unfavorable	3,000	Needlegrass	10
				Sideoats grama	5
				Leadplant	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
CaA, CaB Carthage	Sandy	Favorable	3,500	Little bluestem	25
		Normal	2,900	Prairie sandreed	20
		Unfavorable	2,000	Big bluestem	15
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
CbA*:					
Carthage	Sandy	Favorable	3,500	Little bluestem	25
		Normal	2,900	Prairie sandreed	20
		Unfavorable	2,000	Big bluestem	15
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
Clarno	Sandy	Favorable	3,500	Little bluestem	25
		Normal	2,900	Prairie sandreed	20
		Unfavorable	2,000	Big bluestem	15
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
CcB*:					
Carthage	Sandy	Favorable	3,500	Little bluestem	25
		Normal	2,900	Prairie sandreed	20
		Unfavorable	2,000	Big bluestem	15
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
Hand	Sandy	Favorable	3,500	Little bluestem	35
		Normal	2,900	Needlegrass	15
		Unfavorable	2,000	Big bluestem	10
				Blue grama	10
				Western wheatgrass	5
				Sedge	5
				Prairie sandreed	5
				Leadplant	5
Cd, Ce Clamo	Subirrigated	Favorable	5,500	Big bluestem	60
		Normal	5,000	Indiangrass	10
		Unfavorable	4,000	Switchgrass	10
				Sedge	10
				Western wheatgrass	5
Cf Clamo	Wetland	Favorable	6,600	Prairie cordgrass	70
		Normal	6,000	Sedge	20
		Unfavorable	4,800		
CgA Clarno	Silty	Favorable	3,600	Needlegrass	40
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
ChB*:					
Clarno	Silty	Same as CgA--Clarno			

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
ChB*:					
Bonilla	Overflow	Favorable	4,400	Big bluestem	55
		Normal	4,000	Western wheatgrass	15
		Unfavorable	2,800	Green needlegrass	10
				Sideoats grama	5
				Leadplant	5
				Sedge	5
CkB*:					
Clarno	Silty	Favorable	3,600	Needlegrass	40
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Dudley	Claypan	Favorable	2,800	Western wheatgrass	50
		Normal	2,300	Blue grama	15
		Unfavorable	1,600	Green needlegrass	10
				Sedge	10
				Buffalograss	5
CmB*:					
Clarno	Silty	Favorable	3,600	Needlegrass	40
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Ethan	Silty	Favorable	3,100	Needlegrass	40
		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Big bluestem	10
				Little bluestem	5
				Sideoats grama	5
				Blue grama	5
				Sedge	5
CoA*:					
Clarno	Silty	Favorable	3,600	Needlegrass	40
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Prosper	Overflow	Favorable	4,700	Big bluestem	55
		Normal	4,300	Western wheatgrass	15
		Unfavorable	3,000	Green needlegrass	10
				Sideoats grama	5
				Leadplant	5
				Sedge	5
DaB Davis	Silty	Favorable	3,800	Needlegrass	35
		Normal	3,200	Big bluestem	15
		Unfavorable	2,200	Western wheatgrass	15
				Little bluestem	15
				Sideoats grama	5
				Leadplant	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Db---------- Davison	Limy Subirrigated----------	Favorable	4,300	Little bluestem----------	30
		Normal	3,600	Needlegrass----------	30
		Unfavorable	2,500	Western wheatgrass----------	10
				Big bluestem----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Dc---------- Davison Variant	Limy Subirrigated----------	Favorable	4,300	Little bluestem----------	30
		Normal	3,600	Needlegrass----------	30
		Unfavorable	2,500	Western wheatgrass----------	10
				Big bluestem----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
DdA---------- Delmont	Shallow to Gravel----------	Favorable	2,500	Needleandthread----------	60
		Normal	2,100	Sedge----------	10
		Unfavorable	1,300	Sideoats grama----------	5
				Prairie dropseed----------	5
				Blue grama----------	5
				Plains muhly----------	5
DeA, DeB---------- Doger	Sandy----------	Favorable	3,100	Little bluestem----------	20
		Normal	2,600	Prairie sandreed----------	20
		Unfavorable	1,800	Needleandthread----------	10
				Sideoats grama----------	10
				Blue grama----------	10
				Big bluestem----------	10
				Sedge----------	10
				Western wheatgrass----------	5
DfA*:					
Dudley----------	Claypan----------	Favorable	2,800	Western wheatgrass----------	50
		Normal	2,300	Blue grama----------	15
		Unfavorable	1,600	Green needlegrass----------	10
				Sedge----------	10
				Buffalograss----------	5
Jerauld----------	Thin Claypan----------	Favorable	1,900	Western wheatgrass----------	40
		Normal	1,600	Blue grama----------	30
		Unfavorable	1,000	Buffalograss----------	10
				Sedge----------	10
Clarno----------	Silty----------	Favorable	3,600	Needlegrass----------	40
		Normal	3,000	Big bluestem----------	15
		Unfavorable	2,100	Little bluestem----------	15
				Western wheatgrass----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Dh---------- Durrstein	Saline Lowland----------	Favorable	3,300	Western wheatgrass----------	50
		Normal	3,000	Cordgrass----------	15
		Unfavorable	2,400	Inland saltgrass----------	15
				Nuttall alkaligrass----------	10
Dk*:					
Durrstein---------	Saline Lowland----------	Favorable	3,300	Western wheatgrass----------	50
		Normal	3,000	Cordgrass----------	15
		Unfavorable	2,400	Inland saltgrass----------	15
				Nuttall alkaligrass----------	10
Farmsworth--------	Claypan----------	Favorable	2,900	Western wheatgrass----------	50
		Normal	2,400	Blue grama----------	15
		Unfavorable	1,700	Green needlegrass----------	10
				Sedge----------	10
				Buffalograss----------	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ea---------- Elsmere	Subirrigated----------	Favorable	5,800	Big bluestem----------	55
		Normal	5,300	Indiangrass----------	15
		Unfavorable	4,200	Switchgrass----------	10
				Sedge----------	10
				Western wheatgrass----------	5
Eb*:					
Elsmere----------	Subirrigated----------	Favorable	5,800	Big bluestem----------	55
		Normal	5,300	Indiangrass----------	15
		Unfavorable	4,200	Switchgrass----------	10
				Sedge----------	10
				Western wheatgrass----------	5
Orwet----------	Subirrigated----------	Favorable	6,100	Big bluestem----------	25
		Normal	5,500	Indiangrass----------	10
		Unfavorable	4,500	Switchgrass----------	10
				Prairie cordgrass----------	10
				Little bluestem----------	6
				Plains bluegrass----------	5
				Western wheatgrass----------	5
				Sedge----------	5
EcA---------- Enet	Silty----------	Favorable	3,600	Needlegrass----------	35
		Normal	3,000	Western wheatgrass----------	20
		Unfavorable	2,100	Little bluestem----------	15
				Big bluestem----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
EdB*:					
Enet----------	Silty----------	Favorable	3,600	Needlegrass----------	35
		Normal	3,000	Western wheatgrass----------	20
		Unfavorable	2,100	Little bluestem----------	15
				Big bluestem----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Delmont----------	Shallow to Gravel----------	Favorable	2,500	Needleandthread----------	60
		Normal	2,100	Sedge----------	10
		Unfavorable	1,300	Sideoats grama----------	5
				Prairie dropseed----------	5
				Blue grama----------	5
				Plains muhly----------	5
EeC*:					
Ethan----------	Silty----------	Favorable	3,100	Needlegrass----------	30
		Normal	2,600	Little bluestem----------	20
		Unfavorable	1,800	Western wheatgrass----------	15
				Big bluestem----------	10
				Sideoats grama----------	10
				Blue grama----------	5
				Sedge----------	5
Clarno----------	Silty----------	Favorable	3,100	Needlegrass----------	40
		Normal	2,600	Western wheatgrass----------	25
		Unfavorable	1,800	Little bluestem----------	15
				Sideoats grama----------	5
				Big bluestem----------	5
				Blue grama----------	5
				Sedge----------	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Fa Fedora	Subirrigated	Favorable	5,500	Big bluestem	60
		Normal	5,000	Indiangrass	10
		Unfavorable	4,000	Switchgrass	10
				Sedge	10
				Western wheatgrass	5
FbA Forestburg	Sandy	Favorable	3,200	Little bluestem	35
		Normal	2,700	Prairie sandreed	15
		Unfavorable	1,900	Big bluestem	10
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
FcB*, FcC*:					
Forestburg	Sandy	Favorable	3,200	Little bluestem	35
		Normal	2,700	Prairie sandreed	15
		Unfavorable	1,900	Big bluestem	10
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
Ethan	Sandy	Favorable	3,100	Little bluestem	35
		Normal	2,600	Needlegrass	15
		Unfavorable	1,800	Western wheatgrass	10
				Sideoats grama	10
				Blue grama	10
				Prairie sandreed	10
				Sedge	5
				Big bluestem	5
HaA*:					
Hand	Silty	Favorable	3,500	Needlegrass	40
		Normal	2,900	Little bluestem	15
		Unfavorable	2,000	Western wheatgrass	15
				Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Bonilla	Overflow	Favorable	4,400	Big bluestem	55
		Normal	4,000	Western wheatgrass	15
		Unfavorable	2,800	Green needlegrass	10
				Sideoats grama	5
				Leadplant	5
				Sedge	5
HbB*:					
Hand	Silty	Favorable	3,500	Needlegrass	40
		Normal	2,900	Little bluestem	15
		Unfavorable	2,000	Western wheatgrass	15
				Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Ethan	Silty	Favorable	3,100	Needlegrass	40
		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Big bluestem	10
				Little bluestem	5
				Sideoats grama	5
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
HcB*:					
Houdek	Silty	Favorable	3,500	Needlegrass	40
		Normal	2,900	Big bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Dudley	Claypan	Favorable	2,800	Western wheatgrass	50
		Normal	2,300	Blue grama	15
		Unfavorable	1,600	Green needlegrass	10
				Sedge	10
				Buffalograss	5
HdB*:					
Houdek	Silty	Favorable	3,500	Needlegrass	40
		Normal	2,900	Big bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Ethan	Silty	Favorable	3,100	Needlegrass	40
		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Big bluestem	10
				Little bluestem	5
				Sideoats grama	5
				Blue grama	5
				Sedge	5
HeA*, HeB*:					
Houdek	Silty	Favorable	3,500	Needlegrass	40
		Normal	2,900	Big bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Prosper	Overflow	Favorable	4,400	Big bluestem	55
		Normal	4,000	Western wheatgrass	15
		Unfavorable	2,800	Green needlegrass	10
				Sideoats grama	5
				Leadplant	5
				Sedge	5
HfA*:					
Houdek	Silty	Favorable	3,500	Needlegrass	40
		Normal	2,900	Big bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Stickney	Clayey	Favorable	3,400	Western wheatgrass	35
		Normal	2,800	Green needlegrass	30
		Unfavorable	2,000	Sideoats grama	10
				Little bluestem	5
				Big bluestem	5
				Blue grama	5
				Sedge	5
Hk Hoven	Closed Depression	Favorable	3,900	Western wheatgrass	85
		Normal	3,500	Sedge	10
		Unfavorable	2,500		

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
HmA*:					
Hoven	Closed Depression	Favorable	3,900	Western wheatgrass	85
		Normal	3,500	Sedge	10
		Unfavorable	2,500		
Durrstein	Saline Lowland	Favorable	3,300	Western wheatgrass	50
		Normal	3,000	Cordgrass	15
		Unfavorable	2,400	Inland saltgrass	15
				Nuttall alkaligrass	10
Ia*:					
Ipage	Sandy	Favorable	3,600	Big bluestem	15
		Normal	3,000	Prairie sandreed	15
		Unfavorable	2,100	Little bluestem	10
				Needleandthread	10
				Sedge	7
				Kentucky bluegrass	5
				Indiangrass	5
				Prairie junegrass	5
				Switchgrass	5
				Scribner panicum	5
				Leadplant	5
Els	Subirrigated	Favorable	5,600	Big bluestem	30
		Normal	5,100	Indiangrass	15
		Unfavorable	4,100	Prairie cordgrass	15
				Switchgrass	10
				Little bluestem	7
				Sedge	7
				Kentucky bluegrass	5
Ja James	Saline Lowland	Favorable	4,400	Cordgrass	40
		Normal	4,000	Western wheatgrass	25
		Unfavorable	3,200	Inland saltgrass	15
				Switchgrass	10
				Sedge	5
La Lamo	Subirrigated	Favorable	5,800	Big bluestem	55
		Normal	5,300	Indiangrass	10
		Unfavorable	4,200	Switchgrass	10
				Sedge	10
				Prairie cordgrass	5
Lb Lute	Saline Lowland	Favorable	3,300	Cordgrass	35
		Normal	3,000	Western wheatgrass	30
		Unfavorable	2,400	Inland saltgrass	25
LdA*:					
Lute	Saline Lowland	Favorable	3,300	Cordgrass	35
		Normal	3,000	Western wheatgrass	30
		Unfavorable	2,400	Inland saltgrass	25
Whitelake	Sandy	Favorable	3,300	Little bluestem	20
		Normal	2,800	Prairie sandreed	20
		Unfavorable	2,000	Needleandthread	10
				Sideoats grama	10
				Blue grama	10
				Big bluestem	10
				Western wheatgrass	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Oa Orwet	Subirrigated	Favorable	6,100	Big bluestem	25
		Normal	5,500	Indiangrass	10
		Unfavorable	4,500	Switchgrass	10
				Prairie cordgrass	10
				Little bluestem	6
				Plains bluegrass	5
				Western wheatgrass	5
				Sedge	5
				Bulrush	5
				Rush	5
Sa*:					
Shue	Subirrigated	Favorable	5,300	Big bluestem	45
		Normal	4,800	Indiangrass	15
		Unfavorable	3,900	Switchgrass	10
				Sedge	10
				Little bluestem	10
				Western wheatgrass	5
Davison	Limy Subirrigated	Favorable	4,300	Needlegrass	30
		Normal	3,600	Little bluestem	30
		Unfavorable	2,500	Western wheatgrass	10
				Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Sb Shue Variant	Subirrigated	Favorable	5,500	Cordgrass	50
		Normal	5,000	Switchgrass	20
		Unfavorable	4,000	Indiangrass	10
				Big bluestem	10
				Sedge	10
Ta, Tb Tetonka	Wet Meadow	Favorable	4,800	Sedge	30
		Normal	4,200	Prairie cordgrass	25
		Unfavorable	2,900	Reedgrass	15
				Western wheatgrass	15
				Bluegrass	5
TcA*:					
Tetonka	Wet Meadow	Favorable	4,800	Sedge	30
		Normal	4,200	Prairie cordgrass	25
		Unfavorable	2,900	Reedgrass	15
				Western wheatgrass	15
				Bluegrass	5
Davison	Limy Subirrigated	Favorable	4,300	Needlegrass	30
		Normal	3,600	Little bluestem	30
		Unfavorable	2,500	Western wheatgrass	10
				Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Clarno	Silty	Favorable	3,600	Needlegrass	40
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Little bluestem	15
				Western wheatgrass	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Td Tetonka Variant	Wet Meadow	Favorable	4,800	Sedge	30
		Normal	4,200	Prairie cordgrass	25
		Unfavorable	2,900	Reedgrass	15
				Western wheatgrass	15
				Bluegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VaC Valentine	Sands	Favorable	3,300	Prairie sandreed	20
		Normal	2,800	Sand bluestem	18
		Unfavorable	2,000	Little bluestem	15
				Switchgrass	8
				Needleandthread	8
				Blue grama	5
				Sand dropseed	5
Wa Wann	Subirrigated	Favorable	5,800	Big bluestem	55
		Normal	5,300	Indiangrass	15
		Unfavorable	4,200	Switchgrass	10
				Sedge	10
				Western wheatgrass	5
Wb*:					
Wann	Subirrigated	Favorable	5,800	Big bluestem	55
		Normal	5,300	Indiangrass	15
		Unfavorable	4,200	Switchgrass	10
				Sedge	10
				Western wheatgrass	5
Lamo	Subirrigated	Favorable	5,800	Big bluestem	55
		Normal	5,300	Indiangrass	10
		Unfavorable	4,200	Switchgrass	10
				Sedge	10
				Prairie cordgrass	5
WcB*:					
Whitelake	Sandy	Favorable	3,300	Little bluestem	20
		Normal	2,800	Prairie sandreed	20
		Unfavorable	2,000	Needleandthread	10
				Sideoats grama	10
				Blue grama	10
				Big bluestem	10
				Western wheatgrass	5
				Sedge	5
Woonsocket	Sandy	Favorable	3,600	Big bluestem	35
		Normal	3,000	Little bluestem	20
		Unfavorable	2,100	Green needlegrass	10
				Western wheatgrass	10
				Sideoats grama	10
				Leadplant	5
				Sedge	5
Wd Woonsocket	Overflow	Favorable	5,000	Big bluestem	55
		Normal	4,200	Western wheatgrass	15
		Unfavorable	3,000	Green needlegrass	10
				Sideoats grama	5
				Leadplant	5
				Sedge	5
We Worthing	Shallow Marsh	Favorable	7,100	Slough sedge	35
		Normal	6,500	Rivergrass	30
		Unfavorable	5,200	Reedgrass	10
				Prairie cordgrass	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AaA, AaB: Alwilda	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
Ab*:					
Artesian	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Farmsworth	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
BaE. Betts					
BbD*:					
Betts.					
Ethan.					
BcA, BcB: Blendon	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
Bd. Bon					
CaA, CaB: Carthage	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
CbA*:					
Carthage	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
CcB*:					
Carthage	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
Hand	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Cd, Ce, Clamo	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Golden willow, common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood	---
Cf. Clamo					
CgA Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
ChB*:					
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Bonilla	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
CkB*:					
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
CmB*:					
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Ethan	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
CoA*:					
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Prosper	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
DaB Davis	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Db Davison	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Dc Davison Variant	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
DdA Delmont	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
DeA, DeB: Doger	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
DfA*:					
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Jerauld.					
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Dh. Durrstein					
Dk*: Durrstein.					
Farmsworth	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Ea: Elsmere	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Eb*:					
Elsmere	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Orwet	Lilac, American plum.	Eastern redcedar, common choke-cherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cotton-wood, golden willow.	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
EcA Enet	Siberian peashrub, Tatarian honeysuckle, buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crab-apple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
EdB*:					
Enet	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
Delmont	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
EeC*:					
Ethan	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Fa Fedora	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
FbA Forestburg	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
FcB*, FcC*:					
Forestburg	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
FcB*, FcC*:					
Ethan	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
HaA*:					
Hand	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Bonilla	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
HbB*:					
Hand	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Ethan	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
HcB*:					
Houdek	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
HdB*:					
Houdek	Lilac	Eastern redcedar, common chokecherry, peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Siberian crabapple.	Blue spruce	---
Ethan	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
HeA*:					
Houdek	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Prosper	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
HeB*:					
Houdek	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Prosper.					
HfA*:					
Houdek	Lilac	Eastern redcedar, common chokecherry. Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Stickney	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Hk. Hoven					
HmA*: Hoven.					
Durrstein.					
Ia*: Ipage	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
Els	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Ja. James					
La Lamo	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Lb, Lc. Lute					
LdA*: Lute.					
Whitelake	American plum, silver buffaloberry, lilac.	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Siberian elm, ponderosa pine, bur oak, Russian-olive.	---	---
Oa Orwet	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Pa*. Pits					
Sa*: Shue	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Sa*:					
Davison	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Sb. Shue Variant					
Ta** Tetonka	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Tb** Tetonka	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
TcA*:					
Tetonka**	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Davison	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Clarno	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Td Tetonka Variant	American plum	Common hackberry, Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Golden willow, blue spruce, Black Hills spruce, green ash, ponderosa pine.	Plains cottonwood	---
VaC Valentine	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---

See footnotes at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Wa Wann	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Wb*:					
Wann	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Lamo	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
WcB*:					
Whitelake	American plum, silver buffaloberry, lilac.	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Siberian elm, ponderosa pine, bur oak, Russian-olive.	---	---
Woonsocket	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
Wd Woonsocket	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
We, Wk. Worthing					

* See description of the map unit for composition and behavior characteristics of the map unit.

** Species are for drained areas only.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AaA, AaB Alwilda	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Ab*:									
Artesian	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Farmsworth	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
BaE Betts	Very poor	Poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
BbD*:									
Betts	Very poor	Poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Ethan	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
BcA, BcB Blendon	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Bd Bon	Very poor	Good	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
CaA, CaB Carthage	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
CbA*:									
Carthage	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Clarno	Fair	Good	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
CcB*:									
Carthage	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Hand	Fair	Good	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
Cd, Ce Clamo	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Cf Clamo	Poor	Poor	Fair	Good	Fair	Fair	Poor	Fair	Fair.
CgA Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
ChB*:									
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bonilla	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
CkB*:									
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Dudley	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
CmB*:									
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
CoA*:									
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Prosper	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
DaB---------- Davis	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Db---------- Davison	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Dc---------- Davison Variant	Good	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
DdA---------- Delmont	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
DeA, DeB---------- Doger	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
DfA*:									
Dudley----------	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Jerauld----------	Very poor	Poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Clarno----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Dh---------- Durrstein	Very poor	Poor	Fair	Poor	Poor	Fair	Very poor	Poor	Fair.
Dk*:									
Durrstein---------	Very poor	Poor	Fair	Poor	Poor	Fair	Very poor	Poor	Fair.
Farmsworth--------	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Ea---------- Elsmere	Poor	Good	Fair	Good	Poor	Poor	Fair	Poor	Fair.
Eb*:									
Elsmere----------	Poor	Good	Fair	Good	Poor	Poor	Fair	Poor	Fair.
Orwet----------	Poor	Fair	Fair	Good	Good	Good	Fair	Good	Fair.
EcA---------- Enet	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
EdB*:									
Enet----------	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Delmont----------	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
EeC*:									
Ethan----------	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
Clarno----------	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Fa---------- Fedora	Fair	Good	Good	Good	Fair	Fair	Good	Fair	Good.
FbA---------- Forestburg	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
FcB*:									
Forestburg--------	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Ethan----------	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
FcC*:									
Forestburg--------	Poor	Poor	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Ethan----------	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
HaA*:									
Hand	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bonilla	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
HbB*:									
Hand	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
HcB*:									
Houdek	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Dudley	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
HdB*:									
Houdek	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
HeA*:									
Houdek	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Prosper	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
HeB*:									
Houdek	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Prosper.									
HfA*:									
Houdek	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Stickney	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Hk Hoven	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
HmA*:									
Hoven	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
Durrstein	Very poor	Poor	Fair	Poor	Poor	Fair	Very poor	Poor	Fair.
Ia*:									
Ipage	Poor	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Els	Poor	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Ja James	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Fair	Fair.
La Lamo	Good	Good	Good	Good	Fair	Fair	Good	Fair	Good.
Lb Lute	Very poor	Very poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
Lc Lute	Very poor	Very poor	Very poor	Very poor	Fair	Fair	Very poor	Fair	Very poor.
LdA*:									
Lute	Very poor	Very poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
Whitelake	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Oa Orwet	Poor	Fair	Fair	Good	Good	Good	Poor	Good	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Pa*. Pits									
Sa*:									
Shue	Poor	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Davison	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Sb Shue Variant	Very poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
Ta, Tb Tetonka	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
TcA*:									
Tetonka	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Davison	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Td Tetonka Variant	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
VaC Valentine	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Wa Wann	Good	Good	Good	Good	Poor	Fair	Good	Fair	Good.
Wb*:									
Wann	Good	Good	Good	Good	Poor	Fair	Good	Fair	Good.
Lamo	Good	Good	Good	Good	Fair	Fair	Good	Fair	Good.
WcB*:									
Whitelake	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Woonsocket	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Wd Woonsocket	Fair	Fair	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
We Worthing	Fair	Good	Fair	Poor	Good	Good	Fair	Good	Fair.
Wk Worthing	Very poor	Very poor	Very poor	Very poor	Good	Good	Very poor	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AaA: Alwilda	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
AaB: Alwilda	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Ab*:					
Artesian	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Farmsworth	Moderate: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
BaE: Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
BbD*:					
Betts	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Ethan	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
BcA: Blendon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
BcB: Blendon	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
Bd: Bon	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
CaA: Carthage	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Slight	Moderate: frost action.
CaB: Carthage	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: frost action.
CbA*:					
Carthage	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Slight	Moderate: frost action.
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
CcB*:					
Carthage	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: frost action.
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Cd, Ce, Cf: Clamo	Severe: floods, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: low strength, wetness, floods.
CgA: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
ChB*:					
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Bonilla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
CkB*:					
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
CmB*:					
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
CoA*:					
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Prosper	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
DaB: Davis	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Db: Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Dc: Davison Variant	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.
DdA: Delmont	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
DeA: Doger	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
DeB: Doger	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
DfA*:					
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
DfA*:					
Jerauld	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Dh Durrstein	Severe: floods, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
Dk*:					
Durrstein	Severe: floods, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
Farmsworth	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
Ea Elsmere	Severe: cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, wetness.
Eb*:					
Elsmere	Severe: cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, wetness.
Orwet	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
EcA Enet	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
EdB*:					
Enet	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Delmont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
EeC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Fa Fedora	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.
FbA Forestburg	Severe: cutbanks cave.	Moderate: wetness, low strength, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: frost action, wetness.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
FcB*, FcC*:					
Forestburg	Severe: cutbanks cave.	Moderate: wetness, low strength, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Moderate: frost action, wetness.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
HaA*:					
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Bonilla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
HbB*:					
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
HcB*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
HdB*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
HeA*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Prosper	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
HeB*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Prosper	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
HfA*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HfA*:					
Stickney	Slight	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Hk Hoven	Severe: floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: wetness, low strength, floods.
HmA*:					
Hoven	Severe: floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: wetness, low strength, floods.
Durrstein	Severe: floods, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
Ia*:					
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.
Els	Severe: wetness, cutbanks cave.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Moderate: wetness, frost action, floods.
Ja James	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.
La Lamo	Severe: floods, wetness.	Severe: floods, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, low strength, shrink-swell.
Lb Lute	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: frost action.
Lc Lute	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
LdA*:					
Lute	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Whitelake	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.
Oa Orwet	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
Pa*. Pits					
Sa*:					
Shue	Severe: cutbanks cave, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, frost action.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sa*:					
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Sb Shue Variant	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
Ta Tetonka	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, low strength.
Tb Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, wetness.
TcA*:					
Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, wetness.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell.	Severe: low strength.
Td Tetonka Variant	Severe: wetness, floods, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
VaC Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Wa Wann	Severe: wetness, floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, frost action.
Wb*:					
Wann	Severe: wetness, floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, frost action.
Lamo	Severe: floods, wetness.	Severe: floods, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, low strength, frost action.
WcB*:					
Whitelake	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.
Woonsocket	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Severe: frost action.
Wd Woonsocket	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.
We, Wk Worthing	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaA, AaB: Alwilda	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ab*:					
Artesian	Severe: wetness, percs slowly.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
Farmsworth	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
BaE: Betts	Severe: percs slowly, slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.	Poor: slope.
BbD*:					
Betts	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
BcA, BcB: Blendon	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Bd: Bon	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods.	Good.
CaA, CaB: Carthage	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Severe: seepage.	Fair: wetness.
CbA*:					
Carthage	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Severe: seepage.	Fair: wetness.
Clarno	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
CcB*:					
Carthage	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Severe: seepage.	Fair: wetness.
Hand	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Cd, Ce, Cf: Clamo	Severe: floods, percs slowly, wetness.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
CgA: Clarno	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ChB*:					
Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Bonilla	Severe: floods, percs slowly, wetness.	Moderate: seepage.	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
CkB*:					
Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Dudley	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
CmB*:					
Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
CoA*:					
Clarno	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Prosper	Severe: floods, wetness, percs slowly.	Slight	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
DaB Davis	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Db Davison	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
Dc Davison Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
DdA Delmont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
DeA, DeB Doger	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
DfA*:					
Dudley	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
Jerauld	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Clarno	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Dh Durrstein	Severe: floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Dk*:					
Durrstein	Severe: floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Farmsworth	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
Ea Elsmere	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Eb*:					
Elsmere	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Orwet	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, too sandy, seepage.
EcA Enet	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
EdB*:					
Enet	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
Delmont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
EeC*:					
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Clarno	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Fa Fedora	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
FbA Forestburg	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too sandy, wetness.
FcB*:					
Forestburg	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too sandy, wetness.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
FcC*:					
Forestburg	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too sandy, wetness.
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HaA*:					
Hand	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Bonilla	Severe: floods, percs slowly, wetness.	Moderate: seepage.	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
HbB*:					
Hand	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
HcB*:					
Houdek	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Dudley	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
HdB*:					
Houdek	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
HeA*:					
Houdek	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Prosper	Severe: floods, wetness, percs slowly.	Slight	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
HeB*:					
Houdek	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Prosper	Severe: floods, wetness, percs slowly.	Slight	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
HfA*:					
Houdek	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Stickney	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Hk Hoven	Severe: percs slowly, floods, wetness.	Slight	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HmA*:					
Hoven	Severe: percs slowly, floods, wetness.	Slight	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Durrstein	Severe: floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Ia*:					
Ipage	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy.
Els	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, seepage.
Ja James	Severe: floods, percs slowly, wetness.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
La Lamo	Severe: persc slowly, wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
Lb Lute	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Lc Lute	Severe: floods, wetness.	Severe: wetness, seepage.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
LdA*:					
Lute	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Whitelake	Severe: wetness.	Moderate: seepage.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
Oa Orwet	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, too sandy, seepage.
Pa*. Pits					
Sa*:					
Shue	Severe: wetness, percs slowly.	Severe: wetness, seepage, floods.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Davison	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
Sb Shue Variant	Severe: floods, wetness, percs slowly.	Severe: seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ta---------- Tetonka	Severe: floods, percs slowly, wetness.	Slight----------	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness, too clayey.
Tb---------- Tetonka	Severe: floods, percs slowly, wetness.	Slight----------	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
TcA*:					
Tetonka----------	Severe: floods, percs slowly, wetness.	Slight----------	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
Davison----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
Clarno----------	Severe: percs slowly, wetness.	Moderate: seepage.	Moderate: wetness.	Slight----------	Good.
Td---------- Tetonka Variant	Severe: floods, wetness, percs slowly.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness.
VaC---------- Valentine	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Wa---------- Wann	Severe: wetness, floods.	Severe: seepage, wetness, floods.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Fair: wetness.
Wb*:					
Wann----------	Severe: wetness, floods.	Severe: seepage, wetness, floods.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Fair: wetness.
Lamo----------	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
WcB*:					
Whitelake----------	Severe: wetness.	Moderate: slope, seepage.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
Woonsocket---------	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage.
Wd---------- Woonsocket	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage.
We---------- Worthing	Severe: percs slowly, floods, wetness.	Slight----------	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness, too clayey.
Wk---------- Worthing	Severe: floods, wetness, percs slowly.	Severe: wetness, floods.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaA, AaB: Alwilda	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
Ab*:				
Artesian	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Farmsworth	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess salt, excess sodium.
BaE: Betts	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
BbD*:				
Betts	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer, small stones.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
BcA, BcB: Blendon	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Bd: Bon	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CaA, CaB: Carthage	Fair: low strength, wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Good.
CbA*:				
Carthage	Fair: low strength, wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Good.
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CcB*:				
Carthage	Fair: low strength, wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Good.
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Cd: Clamo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Ce, Cf: Clamo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
CgA: Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ChB*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CkB*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Dudley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
CmB*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CoA*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Prosper	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
DaB Davis	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Db Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Dc Davison Variant	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
DdA Delmont	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
DeA, DeB Doger	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
DfA*:				
Dudley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Jerauld	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium.
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Dh Durrstein	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess salt, wetness.
Dk*:				
Durrstein	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess salt, wetness.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Dk*:				
Farmsworth	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess salt, excess sodium.
Ea Elsmere	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Eb*:				
Elsmere	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Orwet	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
EcA Enet	Good	Fair: excess fines.	Fair: excess fines.	Good.
EdB*:				
Enet	Good	Fair: excess fines.	Fair: excess fines.	Good.
Delmont	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
EeC*:				
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Fa Fedora	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Good.
FbA Forestburg	Fair: low strength, wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: too sandy.
FcB*, FcC*:				
Forestburg	Fair: low strength, wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: too sandy.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too sandy.
HaA*:				
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
HbB*:				
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
HcB*:				
Houdek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HcB*:				
Dudley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
HdB*:				
Houdek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
HeA*, HeB*:				
Houdek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Prosper	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
HfA*:				
Houdek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Stickney	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt, excess sodium.
Hk Hoven	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness, excess salt.
HmA*:				
Hoven	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness, excess salt.
Durrstein	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess salt, wetness.
Ia*:				
Ipage	Fair: frost action.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Els	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Ja James	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, excess salt, wetness.
La Lamo	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Lb Lute	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: excess sodium, excess salt, thin layer.
Lc Lute	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt, excess sodium.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LdA*:				
Lute	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: excess sodium, excess salt, thin layer.
Whitelake	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: excess sodium, excess salt.
Oa Orwet	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
Pa*. Pits				
Sa*:				
Shue	Poor: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Sb Shue Variant	Poor: wetness.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Fair: too sandy.
Ta Tetonka	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Tb Tetonka	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
TcA*:				
Tetonka	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Td Tetonka Variant	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
VaC Valentine	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Wa Wann	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
Wb*:				
Wann	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
Lamo	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WcB*:				
Whitelake	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: excess sodium, excess salt.
Woonsocket	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Wd Woonsocket	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
We, Wk Worthing	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
AaA: Alwilda	Seepage	Seepage	No water	Soil blowing, droughty.	Soil blowing, too sandy.	Droughty.
AaB: Alwilda	Seepage	Seepage	No water	Soil blowing, slope, droughty.	Soil blowing, too sandy.	Droughty.
Ab*:						
Artesian	Favorable	Hard to pack	Deep to water, slow refill.	Slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Farmsworth	Favorable	Hard to pack, excess salt, piping.	Deep to water, salty water.	Excess salt, percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, excess salt, erodes easily.
BaE: Betts	Slope	Favorable	No water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
BbD*:						
Betts	Slope	Favorable	No water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Ethan	Slope	Favorable	No water	Slope	Slope	Slope, erodes easily.
BcA: Blendon	Seepage	Seepage, piping.	No water	Soil blowing	Too sandy, soil blowing.	Favorable.
BcB: Blendon	Seepage, slope.	Seepage, piping.	No water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
Bd: Bon	Seepage	Favorable	No water	Floods	Favorable	Favorable.
CaA, CaB: Carthage	Favorable	Favorable	Deep to water, slow refill.	Soil blowing	Soil blowing, erodes easily.	Erodes easily.
CbA*:						
Carthage	Favorable	Favorable	Deep to water, slow refill.	Soil blowing	Soil blowing, erodes easily.	Erodes easily.
Clarno	Favorable	Favorable	No water	Soil blowing	Soil blowing, erodes easily.	Erodes easily.
CcB*:						
Carthage	Favorable	Favorable	Deep to water, slow refill.	Soil blowing	Soil blowing, erodes easily.	Erodes easily.
Hand	Seepage	Favorable	No water	Soil blowing	Soil blowing	Favorable.
Cd: Clamo	Favorable	Wetness, hard to pack.	Slow refill	Percs slowly, wetness.	Percs slowly, wetness.	Wetness, percs slowly.
Ce, Cf: Clamo	Favorable	Wetness, hard to pack.	Slow refill	Percs slowly, floods, slow intake.	Percs slowly, wetness.	Wetness, percs slowly.
CgA: Clarno	Favorable	Favorable	No water	Favorable	Erodes easily	Erodes easily.
ChB*:						
Clarno	Favorable	Favorable	No water	Favorable	Erodes easily	Erodes easily.
Bonilla	Seepage	Favorable	Deep to water, slow refill.	Floods	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
CkB*:						
Clarno	Favorable	Favorable	No water	Favorable	Erodes easily	Erodes easily.
Dudley	Favorable	Hard to pack, piping.	No water	Slow intake, percs slowly, excess sodium.	Percs slowly	Excess sodium, percs slowly, excess salt.
CmB*:						
Clarno	Favorable	Favorable	No water	Favorable	Erodes easily	Erodes easily.
Ethan	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
CoA*:						
Clarno	Favorable	Favorable	No water	Favorable	Erodes easily	Erodes easily.
Prosper	Favorable	Favorable	Deep to water	Floods	Not needed	Favorable.
DaB Davis	Seepage	Favorable	No water	Favorable	Favorable	Favorable.
Db Davison	Seepage	Wetness	Deep to water, slow refill.	Wetness, erodes easily.	Wetness	Erodes easily.
Dc Davison Variant	Seepage	Piping	Deep to water	Favorable	Erodes easily	Erodes easily.
DdA Delmont	Seepage	Seepage	No water	Droughty	Not needed	Droughty.
DeA, DeB Doger	Seepage	Piping, seepage.	No water	Fast intake, soil blowing, droughty.	Too sandy, soil blowing.	Droughty.
DfA*:						
Dudley	Favorable	Hard to pack, piping.	No water	Slow intake, percs slowly, excess sodium.	Percs slowly	Excess sodium, percs slowly, excess salt.
Jerauld	Favorable	Hard to pack, piping.	No water	Slow intake, excess salt, excess sodium.	Erodes easily, percs slowly.	Excess sodium, percs slowly, erodes easily.
Clarno	Favorable	Favorable	No water	Favorable	Erodes easily	Erodes easily.
Dh Durrstein	Favorable	Hard to pack, wetness.	Slow refill	Floods, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Excess sodium, excess salt, wetness.
Dk*:						
Durrstein	Favorable	Hard to pack, wetness.	Slow refill	Floods, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Excess sodium, excess salt, wetness.
Farmsworth	Favorable	Hard to pack, excess salt, piping.	Deep to water, salty water.	Excess salt, percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, excess salt, erodes easily.
Ea Elsmere	Seepage	Piping, seepage, wetness.	Slow refill	Fast intake, wetness, soil blowing.	Not needed	Favorable.
Eb*:						
Elsmere	Seepage	Piping, seepage, wetness.	Slow refill	Fast intake, wetness, soil blowing.	Not needed	Favorable.
Orwet	Seepage	Seepage, wetness.	Favorable	Wetness, droughty, soil blowing.	Not needed	Wetness, droughty.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
EcA: Enet	Seepage	Seepage	No water	Favorable	Too sandy	Favorable.
EdB*:						
Enet	Seepage	Seepage	No water	Favorable	Too sandy	Favorable.
Delmont	Seepage	Seepage	No water	Droughty	Too sandy	Droughty.
EeC*:						
Ethan	Slope	Favorable	No water	Slope	Favorable	Erodes easily.
Clarno	Slope	Favorable	No water	Slope	Erodes easily	Erodes easily.
Fa: Fedora	Seepage	Piping, seepage.	Favorable	Wetness, soil blowing.	Not needed	Wetness.
FbA: Forestburg	Favorable	Favorable	Slow refill, deep to water.	Wetness, fast intake, soil blowing.	Wetness, too sandy, soil blowing.	Erodes easily.
FcB*:						
Forestburg	Favorable	Favorable	Slow refill, deep to water.	Wetness, fast intake, soil blowing.	Wetness, too sandy, soil blowing.	Slope, erodes easily.
Ethan	Favorable	Favorable	No water	Soil blowing	Soil blowing	Erodes easily.
FcC*:						
Forestburg	Slope	Favorable	Slow refill, deep to water.	Wetness, fast intake, soil blowing.	Wetness, too sandy, soil blowing.	Slope, erodes easily.
Ethan	Slope	Favorable	No water	Soil blowing, slope.	Soil blowing	Erodes easily.
HaA*:						
Hand	Seepage	Favorable	No water	Favorable	Favorable	Favorable.
Bonilla	Seepage	Favorable	Deep to water, slow refill.	Floods	Erodes easily	Erodes easily.
HbB*:						
Hand	Seepage	Favorable	No water	Favorable	Favorable	Favorable.
Ethan	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
HcB*:						
Houdek	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
Dudley	Favorable	Hard to pack, piping.	No water	Slow intake, percs slowly, excess sodium.	Percs slowly	Excess sodium, percs slowly, excess salt.
HdB*:						
Houdek	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
Ethan	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
HeA*, HeB*:						
Houdek	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
Prosper	Favorable	Favorable	Deep to water	Floods	Not needed	Favorable.
HfA*:						
Houdek	Favorable	Favorable	No water	Favorable	Favorable	Erodes easily.
Stickney	Favorable	Hard to pack, excess salt.	No water	Percs slowly, excess salt, excess sodium.	Percs slowly	Excess salt, excess sodium, erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
Hk: Hoven	Favorable	Hard to pack, piping, wetness.	Slow refill	Wetness, percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Excess salt, wetness, excess sodium.
HmA*:						
Hoven	Favorable	Hard to pack, piping, wetness.	Slow refill	Wetness, percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Excess salt, wetness, excess sodium.
Durrstein	Favorable	Hard to pack, wetness.	Slow refill	Floods, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Excess sodium, excess salt, wetness.
Ia*:						
Ipage	Seepage	Seepage	Favorable	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Els	Seepage	Seepage	Deep to water	Fast intake, wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
Ja: James	Favorable	Hard to pack, wetness.	Slow refill	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Excess salt, wetness, percs slowly.
La: Lamo	Favorable	Hard to pack, wetness.	Deep to water, slow refill.	Floods, wetness.	Not needed	Favorable.
Lb: Lute	Seepage	Piping, wetness, excess salt.	Salty water	Wetness, soil blowing.	Wetness, percs slowly.	Wetness, excess sodium, percs slowly.
Lc: Lute	Seepage	Piping, wetness, excess salt.	Deep to water, slow refill.	Wetness, excess salt.	Wetness, percs slowly.	Wetness, excess salt.
LdA*:						
Lute	Seepage	Piping, wetness, excess salt.	Salty water	Wetness, soil blowing.	Wetness, percs slowly.	Wetness, excess sodium, percs slowly.
Whitelake	Seepage	Piping, wetness, excess salt.	Deep to water, slow refill, salty water.	Soil blowing, wetness, excess sodium.	Soil blowing, wetness.	Excess salt, percs slowly, excess sodium.
Oa: Orwet	Seepage	Seepage, wetness.	Favorable	Soil blowing, wetness.	Not needed	Wetness, droughty.
Pa*. Pits						
Sa*:						
Shue	Seepage	Wetness	Slow refill	Wetness, fast intake, soil blowing.	Wetness, soil blowing.	Wetness.
Davison	Seepage	Wetness	Deep to water, slow refill.	Wetness, erodes easily.	Wetness	Erodes easily.
Sb: Shue Variant	Seepage	Seepage, piping, wetness.	Slow refill	Wetness, fast intake, floods.	Wetness, soil blowing.	Wetness.
Ta: Tetonka	Favorable	Wetness, hard to pack.	Slow refill	Percs slowly, wetness, soil blowing.	Wetness, percs slowly, soil blowing.	Wetness, percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
Tb---------- Tetonka	Favorable------	Wetness, hard to pack.	Slow refill----	Floods, percs slowly, wetness.	Not needed-----	Wetness, percs slowly.
TcA*:						
Tetonka----------	Favorable------	Wetness, hard to pack.	Slow refill----	Floods, percs slowly, wetness.	Not needed-----	Wetness, percs slowly.
Davison----------	Seepage--------	Wetness--------	Deep to water, slow refill.	Wetness, erodes easily.	Wetness--------	Erodes easily.
Clarno----------	Favorable------	Favorable------	No water-------	Favorable------	Erodes easily	Erodes easily.
Td---------- Tetonka Variant	Seepage--------	Piping, wetness.	Slow refill----	Wetness, soil blowing, percs slowly.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.
VaC---------- Valentine	Seepage, slope.	Seepage, piping.	No water-------	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Droughty.
Wa---------- Wann	Seepage--------	Seepage--------	Favorable------	Floods, soil blowing, wetness.	Wetness--------	Favorable.
Wb*:						
Wann----------	Seepage--------	Seepage--------	Favorable------	Floods, wetness.	Wetness--------	Favorable.
Lamo----------	Favorable------	Hard to pack, wetness.	Deep to water, slow refill.	Floods, wetness.	Not needed-----	Favorable.
WcB*:						
Whitelake--------	Seepage--------	Piping, wetness, excess salt.	Deep to water, slow refill, salty water.	Soil blowing, wetness, excess sodium.	Soil blowing, wetness.	Excess salt, percs slowly, excess sodium.
Woonsocket-------	Seepage--------	Seepage, piping.	Deep to water	Soil blowing---	Soil blowing, too sandy.	Favorable.
Wd---------- Woonsocket	Seepage--------	Seepage, piping.	Deep to water	Soil blowing---	Soil blowing, too sandy.	Favorable.
We, Wk---------- Worthing	Favorable------	Hard to pack, wetness.	Slow refill----	Wetness, percs slowly, floods.	Wetness, percs slowly, erodes easily.	Wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
AaA, AaB---------- Alwilda	0-12	Fine sandy loam	SM	A-4	0	100	100	75-100	35-50	20-30	NP-7
	12-24	Fine sandy loam, sandy loam.	SM	A-4	0	100	100	75-100	35-50	20-30	NP-7
	24-29	Loamy fine sand, loamy sand.	SM, SM-SC	A-2	0	100	100	50-100	15-35	<25	NP-5
	29-60	Gravelly sand, gravelly loamy sand.	SP-SM, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-90	45-80	25-70	5-30	<25	NP-5
Ab*:											
Artesian----------	0-7	Silty clay------	CH, CL	A-7	0	100	100	95-100	80-95	40-60	15-30
	7-22	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	85-95	50-70	20-40
	22-60	Clay, silty clay, clay loam.	CH, MH	A-7	0	100	100	90-100	70-90	50-85	20-50
Farmsworth--------	0-6	Loam, clay loam	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	70-95	25-40	5-15
	6-22	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	85-95	50-70	20-40
	22-53	Clay, silty clay	CH, MH	A-7	0	95-100	95-100	85-100	80-95	50-65	20-35
	53-60	Sandy clay loam	SC, CL	A-4, A-6	0	95-100	95-100	70-100	35-55	30-45	12-27
BaE---------- Betts	0-5	Loam----------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	5-24	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	24-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
BbD*:											
Betts----------	0-5	Loam----------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	5-24	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	24-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
Ethan----------	0-9	Loam----------	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	9-24	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	24-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
BcA---------- Biendon	0-10	Fine sandy loam	SM	A-4	0	100	90-100	60-100	35-50	20-30	NP-5
	10-34	Fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	85-100	60-100	35-60	20-33	NP-10
	34-60	Fine sandy loam, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-4	0	85-100	65-100	50-100	10-45	<30	NP-5
BcB---------- Blendon	0-10	Fine sandy loam	SM	A-4	0	100	90-100	60-100	35-50	20-30	NP-5
	10-30	Fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	85-100	60-100	35-60	20-33	NP-10
	30-60	Fine sandy loam, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-4	0	85-100	65-100	50-100	10-45	<30	NP-5
Bd---------- Bon	0-32	Loam----------	CL-ML, CL	A-4, A-6	0	100	95-100	80-95	60-85	25-40	5-15
	32-60	Stratified silt loam to fine sandy loam.	CL, ML	A-4, A-6	0	100	95-100	80-95	60-85	30-40	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
CaA, CaB---------- Carthage	0-7	Fine sandy loam	SM, SC, ML, CL	A-2, A-4	0-5	95-100	90-100	60-100	25-55	20-30	NP-10
	7-27	Fine sandy loam, sandy loam.	SM, SM-SC, SC, ML	A-2, A-4	0-5	95-100	90-100	50-100	15-55	<25	NP-10
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	95-100	80-95	55-80	30-45	8-20
CbA*:											
Carthage----------	0-7	Fine sandy loam	SM, SC, ML, CL	A-2, A-4	0-5	95-100	90-100	60-100	25-55	20-30	NP-10
	7-21	Fine sandy loam, sandy loam.	SM, SM-SC, SC, ML	A-2, A-4	0-5	95-100	90-100	50-100	15-55	<25	NP-10
	21-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	95-100	80-95	55-80	30-45	8-20
Clarno----------	0-7	Fine sandy loam	SM, ML	A-4	0	100	100	90-100	40-55	<30	NP-7
	7-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
CcB*:											
Carthage----------	0-7	Fine sandy loam	SM, SC, ML, CL	A-2, A-4	0-5	95-100	90-100	60-100	25-55	20-30	NP-10
	7-22	Fine sandy loam, sandy loam.	SM, SM-SC, SC, ML	A-2, A-4	0-5	95-100	90-100	50-100	15-55	<25	NP-10
	22-28	Loamy fine sand, loamy sand.	SM, SM-SC	A-2	0-5	95-100	90-100	50-100	15-35	<25	NP-5
	28-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	95-100	80-95	55-80	30-45	8-20
Hand----------	0-9	Fine sandy loam	SM, ML	A-4	0	100	95-100	85-100	40-55	<30	NP-7
	9-24	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0-5	95-100	80-100	75-100	50-80	25-40	5-20
	24-60	Stratified silt loam to fine sandy loam.	CL, CL-ML	A-4, A-6	0-5	95-100	80-100	70-100	50-80	25-40	5-15
Cd---------- Clamo	0-15	Loam----------	ML	A-4, A-6, A-7	0	100	95-100	90-100	60-75	30-45	5-15
	15-60	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	45-75	20-40
Ce, Cf---------- Clamo	0-14	Silty clay------	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	40-60	15-28
	14-60	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	45-75	20-40
CgA---------- Clarno	0-6	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	6-31	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
ChB*:											
Clarno----------	0-6	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	6-31	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Bonilla----------	0-8	Loam----------	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	8-30	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-45	10-22
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
CkB*:											
Clarno	0-9	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	9-31	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Dudley	0-8	Silt loam	CL-ML, CL	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	30-45	5-20
	8-21	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	21-31	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	31-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35
CmB*:											
Clarno	0-6	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	6-22	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	22-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Ethan	0-9	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	9-24	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	24-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
CoA*:											
Clarno	0-6	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	6-31	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Prosper	0-11	Loam	CL	A-4, A-6	0	95-100	95-100	85-100	60-90	25-40	8-20
	11-30	Clay loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	85-100	60-90	35-50	10-25
	30-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-85	30-50	10-25
DaB Davis	0-10	Loam	CL	A-6, A-7	0	100	90-100	80-100	60-85	30-45	10-20
	10-37	Loam, silt loam, clay loam.	CL	A-6, A-7	0	100	90-100	80-100	60-85	30-45	10-20
	37-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	55-90	30-45	10-20
Db Davison	0-8	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	8-28	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	28-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20
Dc Davison Variant	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	8-60	Silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	75-100	20-35	2-12
DdA Delmont	0-5	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	5-14	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	14-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2	0-5	60-100	40-70	15-50	0-30	<25	NP-5
DeA, DeB Doger	0-14	Loamy fine sand	SM, SP-SM, SM-SC	A-2, A-3, A-4	0	100	100	95-100	5-45	<25	NP-5
	14-60	Loamy fine sand, loamy sand, fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	95-100	5-35	<25	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
DfA*:											
Dudley	0-8	Silt loam	CL-ML, CL	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	30-45	5-20
	8-21	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	21-31	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	31-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35
Jerauld	0-5	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	60-100	25-40	5-15
	5-17	Silty clay, clay, clay loam.	CH, CL, MH	A-7	0	95-100	95-100	90-100	55-95	45-70	20-40
	17-60	Silty clay, silty clay loam, clay loam.	CL, CH, MH	A-7	0	95-100	95-100	85-100	55-90	40-85	20-45
Clarno	0-9	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	9-31	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Dh Durrstein	0-1	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	3-15
	1-12	Silty clay, clay	CH, MH	A-7	0	95-100	95-100	85-100	65-95	50-85	20-55
	12-60	Silty clay, clay, clay loam.	CH, CL, MH	A-7	0	95-100	95-100	85-100	60-95	40-75	15-55
Dk*:											
Durrstein	0-1	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	3-15
	1-12	Silty clay, clay	CH, MH	A-7	0	95-100	95-100	85-100	65-95	50-85	20-55
	12-60	Silty clay, clay, clay loam.	CH, CL, MH	A-7	0	95-100	95-100	85-100	60-95	40-75	15-55
Farmsworth	0-6	Loam	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	70-95	25-40	5-15
	6-22	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	85-95	50-70	20-40
	22-53	Clay, silty clay	CH, MH	A-7	0	95-100	95-100	85-100	80-95	50-65	20-35
	53-60	Sandy clay loam	SC, CL	A-4, A-6	0	95-100	95-100	70-100	35-55	30-45	12-27
Ea Elsmere	0-16	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	90-100	70-100	15-45	<25	NP-5
	16-45	Fine sand, loamy fine sand, loamy sand.	SM, SM-SC	A-2, A-4	0	100	90-100	70-100	12-45	<25	NP-5
	45-60	Clay loam, silt loam, very fine sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-7	0	100	90-100	60-100	45-90	25-45	5-20
Eb*:											
Elsmere	0-16	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	90-100	70-100	15-45	<25	NP-5
	16-45	Fine sand, loamy fine sand, loamy sand.	SM, SM-SC	A-2, A-4	0	100	90-100	70-100	12-45	<25	NP-5
	45-60	Clay loam, silt loam, very fine sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-7	0	100	90-100	60-100	45-90	25-45	5-20
Orwet	0-6	Sandy loam	SM	A-4	0	95-100	95-100	60-70	40-50	---	NP
	6-60	Loamy fine sand, fine sand.	SM	A-2	0	95-100	95-100	51-85	15-30	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
EcA---------- Enet	0-8	Loam----------	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	8-27	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	27-60	Gravelly loamy sand, gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-90	45-70	10-60	0-15	<20	NP-5
EdB*:											
Enet----------	0-8	Loam----------	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	8-24	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	24-60	Gravelly loamy sand, gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-90	45-70	10-60	0-15	<20	NP-5
Delmont----------	0-5	Loam----------	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	5-12	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	12-60	Sand and gravel, gravelly loamy sand, gravelly sand.	SP, SM, GP, GM	A-1, A-2	0-5	60-100	40-70	15-50	0-30	<25	NP-5
EeC*:											
Ethan----------	0-9	Loam----------	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	9-24	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	24-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Clarno----------	0-6	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	6-31	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Fa---------- Fedora	0-10	Fine sandy loam	SC, SM-SC	A-4	0	95-100	95-100	60-90	35-50	20-30	5-10
	10-15	Sandy loam, fine sandy loam, loamy sand.	SC, SM, SM-SC	A-4, A-2	0	95-100	95-100	65-100	25-45	15-30	NP-10
	15-48	Sandy loam, loam, fine sandy loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	95-100	95-100	60-95	35-65	20-35	5-15
	48-60	Loamy fine sand, fine sand, gravelly sand.	SM, SP-SM, SM-SC	A-1, A-2, A-3	0	60-100	50-100	30-75	5-25	<25	NP-5
FbA---------- Forestburg	0-6	Loamy fine sand	SM, SM-SC	A-2	0-5	95-100	90-100	70-100	15-35	<25	NP-5
	6-28	Loamy sand, loamy fine sand.	SM, SM-SC	A-2	0-5	95-100	90-100	70-100	15-35	<25	NP-5
	28-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	95-100	80-95	60-90	30-45	8-20
FcB*:											
Forestburg--------	0-6	Loamy fine sand	SM, SM-SC	A-2	0-5	95-100	90-100	70-100	15-35	<25	NP-5
	6-28	Loamy sand, loamy fine sand.	SM, SM-SC	A-2	0-5	95-100	90-100	70-100	15-35	<25	NP-5
	28-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	95-100	80-95	60-90	30-45	8-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
FcB*:											
Ethan	0-7	Loamy fine sand	SM, SM-SC	A-2	0	95-100	95-100	90-100	15-35	<25	NP-7
	7-20	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	20-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
FcC*:											
Forestburg	0-6	Loamy fine sand	SM, SM-SC	A-2	0-5	95-100	90-100	70-100	15-35	<25	NP-5
	6-24	Loamy sand, loamy fine sand.	SM, SM-SC	A-2	0-5	95-100	90-100	70-100	15-35	<25	NP-5
	24-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	95-100	80-95	60-90	30-45	8-20
Ethan	0-7	Loamy fine sand	SM, SM-SC	A-2	0	95-100	95-100	90-100	15-35	<25	NP-7
	7-20	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	20-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
HaA*:											
Hand	0-9	Loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	75-100	50-85	25-40	5-20
	9-24	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0-5	95-100	80-100	75-100	50-80	25-40	5-20
	24-60	Stratified silt loam to fine sandy loam.	CL, CL-ML	A-4, A-6	0-5	95-100	80-100	70-100	50-80	25-40	5-15
Bonilla	0-9	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	9-23	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-45	10-22
	23-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
	33-60	Stratified clay loam to fine sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0-5	95-100	85-100	70-95	40-90	20-35	5-15
HbB*:											
Hand	0-9	Loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	75-100	50-85	25-40	5-20
	9-24	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0-5	95-100	80-100	75-100	50-80	25-40	5-20
	24-60	Stratified silt loam to fine sandy loam.	CL, CL-ML	A-4, A-6	0-5	95-100	80-100	70-100	50-80	25-40	5-15
Ethan	0-9	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	9-24	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	24-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
HcB*:											
Houdek	0-8	Loam	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-85	30-45	8-20
	8-27	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-50	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-50	10-25
Dudley	0-8	Silt loam	CL-ML, CL	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	30-45	5-20
	8-21	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	21-31	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	31-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
HdB*:											
Houdek	0-8	Loam	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-85	30-45	8-20
	8-27	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-50	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-50	10-25
Ethan	0-9	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	9-24	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	24-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
HeA*, HeB*:											
Houdek	0-8	Loam	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-85	30-45	8-20
	8-27	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-50	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-50	10-25
Prosper	0-11	Loam	CL	A-4, A-6	0	95-100	95-100	85-100	60-90	25-40	8-20
	11-30	Clay loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	85-100	60-90	35-50	10-25
	30-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-85	30-50	10-25
HfA*:											
Houdek	0-8	Loam	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-85	30-45	8-20
	8-27	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-50	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-50	10-25
Stickney	0-10	Loam, silt loam	CL	A-4, A-6	0	100	95-100	85-95	60-90	30-40	8-15
	10-31	Clay loam, silty clay, clay.	CL, CH, MH	A-6, A-7	0	100	95-100	85-100	65-95	35-60	14-35
	31-60	Clay loam, loam	CL, CH, MH, ML	A-6, A-7	0-5	95-100	90-100	80-100	55-90	35-55	10-30
Hk Hoven	0-3	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	3-31	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-45
	31-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
HmA*:											
Hoven	0-3	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	3-31	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-45
	31-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
Durrstein	0-1	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	3-15
	1-12	Silty clay, clay	CH, MH	A-7	0	95-100	95-100	85-100	65-95	50-85	20-55
	12-60	Silty clay, clay, clay loam.	CH, CL, MH	A-7	0	95-100	95-100	85-100	60-95	40-75	15-55

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Ia*:											
Ipage	0-6	Loamy fine sand	SM	A-2	0	100	100	50-75	15-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP
Els	0-8	Loamy fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-95	5-35	---	NP
	8-60	Fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	90-100	90-100	70-95	5-30	---	NP
Ja James	0-10	Silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-45
	10-60	Silty clay, clay, silty clay loam.	CL, CH, MH	A-7	0	100	100	90-100	85-100	45-80	20-40
La Lamo	0-17	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	85-95	40-65	14-35
	17-60	Silty clay loam, silt loam, silty clay.	CL, CH, ML, MH	A-7, A-6	0	100	100	95-100	85-95	35-60	10-35
Lb Lute	0-2	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	70-100	30-55	20-30	2-10
	2-16	Sandy clay loam, fine sandy loam.	ML, SM, SC, CL	A-4, A-6	0	100	100	60-100	35-55	20-35	2-15
	16-60	Stratified very fine sandy loam to loamy sand.	ML, CL, SM, SC	A-1, A-2, A-4	0	100	100	45-100	15-55	15-30	NP-10
Lc Lute	0-2	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	70-100	30-55	20-30	2-10
	2-17	Sandy clay loam, fine sandy loam.	ML, SM, SC, CL	A-4, A-6	0	100	100	60-100	35-55	20-35	2-15
	17-60	Stratified very fine sandy loam to loamy sand.	ML, CL, SM, SC	A-1, A-2, A-4	0	100	100	45-100	15-55	15-30	NP-10
LdA*:											
Lute	0-2	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	70-100	30-55	20-30	2-10
	2-16	Sandy clay loam, fine sandy loam.	ML, SM, SC, CL	A-4, A-6	0	100	100	60-100	35-55	20-35	2-15
	16-60	Stratified very fine sandy loam to loamy sand.	ML, CL, SM, SC	A-1, A-2, A-4	0	100	100	45-100	15-55	15-30	NP-10
Whitelake	0-8	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	70-100	30-55	<25	NP-5
	8-12	Fine sandy loam, sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	70-100	30-50	<25	NP-5
	12-27	Sandy clay loam, fine sandy loam.	SM-SC, CL-ML, SC, CL	A-4, A-6	0	100	100	60-100	35-55	25-36	6-17
	27-60	Stratified sand to silt loam.	ML, CL, SM, SC	A-2, A-4	0	100	95-100	60-100	20-65	15-35	NP-12

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Oa---------- Orwet	0-6	Fine sandy loam	SM	A-4	0	95-100	95-100	60-70	40-50	---	NP
	6-60	Loamy fine sand, fine sand.	SM	A-2	0	95-100	95-100	51-85	15-30	---	NP
Pa*. Pits											
Sa*:											
Shue----------	0-15	Loamy fine sand	SM, SM-SC, SP-SM	A-2, A-3	0	100	95-100	75-100	5-35	<25	NP-5
	15-29	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	95-100	75-100	5-35	<25	NP-5
	29-60	Clay loam, loam	CL, ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	50-80	30-45	5-20
Davison----------	0-7	Fine sandy loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	7-40	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	40-60	Stratified clay loam to sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0-5	90-100	80-100	65-95	40-75	20-35	5-15
Sb---------- Shue Variant	0-12	Loamy fine sand	SM, SM-SC, SP-SM	A-2	0	100	95-100	75-100	5-35	<25	NP-5
	12-36	Loamy fine sand, fine sand, loamy sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	95-100	75-100	5-35	<25	NP-5
	36-60	Silt loam, silty clay loam, clay loam.	CL, ML	---	0	100	95-100	90-100	70-100	30-45	5-20
Ta---------- Tetonka	0-14	Loamy fine sand	SM, SM-SC, SP-SM	A-2	0	100	95-100	50-80	10-35	<25	NP-5
	14-33	Clay, silty clay	CL, CH, ML, MH	A-7	0	100	100	85-100	80-100	40-65	15-30
	33-60	Clay loam, clay	CL, CH, ML, MH	A-6, A-7	0	100	90-100	80-100	65-95	35-65	15-30
Tb---------- Tetonka	0-13	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	13-16	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	10-25
	16-49	Clay, silty clay, clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	65-100	40-70	15-35
	49-60	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	95-100	80-100	55-95	30-60	11-30
TcA*:											
Tetonka----------	0-13	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	13-16	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	10-25
	16-49	Clay, silty clay, clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	65-100	40-70	15-35
	49-60	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	95-100	80-100	55-95	30-60	11-30
Davison----------	0-8	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	8-28	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	28-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
TcA*:											
Clarno	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	8-30	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Td Tetonka Variant	0-15	Fine sandy loam	SM, SM-SC, SC	A-4	0	100	100	90-100	35-50	20-35	3-10
	15-19	Fine sandy loam, loamy fine sand, loamy sand.	SM, ML	A-2, A-4	0	100	100	90-100	15-55	<30	NP-7
	19-34	Sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	90-100	35-55	25-40	5-15
	34-42	Fine sandy loam, sandy clay loam, sandy loam.	SC, SM, SM-SC	A-4, A-6	0	100	95-100	90-100	35-50	20-35	3-11
	42-60	Loamy fine sand, loamy sand, fine sand.	SM	A-2	0	100	95-100	90-100	15-30	<30	NP-5
VaC Valentine	0-5	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
Wa Wann	0-8	Fine sandy loam	SM, SM-SC	A-2, A-4	0	95-100	95-100	70-100	30-50	<25	NP-5
	8-43	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	95-100	60-100	20-50	<25	NP-5
	43-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-100	15-35	<20	NP
Wb*:											
Wann	0-17	Loam	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	85-100	55-75	15-30	2-15
	17-42	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	95-100	60-100	20-50	<25	NP-5
	42-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-100	15-35	<20	NP
Lamo	0-17	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	85-95	40-65	14-35
	17-60	Silty clay loam, silt loam, silty clay.	CL, CH, ML, MH	A-7, A-6	0	100	100	95-100	85-95	35-60	10-35
WcB*:											
Whitelake	0-8	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	70-100	30-55	<25	NP-5
	8-12	Fine sandy loam, sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	70-100	30-50	<25	NP-5
	12-27	Sandy clay loam, fine sandy loam.	SM-SC, CL-ML, SC, CL	A-4, A-6	0	100	100	60-100	35-55	25-36	6-17
	27-60	Stratified sand to silt loam.	ML, CL, SM, SC	A-2, A-4	0	100	95-100	60-100	20-65	15-35	NP-12

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
WcB*:											
Woonsocket	0-12	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	100	95-100	85-100	30-55	20-30	NP-7
	12-28	Sandy clay loam, sandy loam, fine sandy loam.	SC, SM-SC	A-4, A-2	0	100	100	65-90	30-50	25-35	5-15
	28-60	Loamy fine sand, loamy sand, sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	95-100	50-85	5-30	<25	NP-5
Wd Woonsocket	0-12	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	100	95-100	85-100	30-55	20-30	NP-7
	12-28	Sandy clay loam, sandy loam, fine sandy loam.	SC, SM-SC	A-4, A-2	0	100	100	65-90	30-50	25-35	5-15
	28-60	Loamy fine sand, loamy sand, fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	95-100	50-85	5-30	<25	NP-5
We Worthing	0-10	Silt loam	CL	A-7, A-6	0	100	100	95-100	85-95	35-45	12-20
	10-35	Silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	85-100	50-70	22-35
	35-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-95	35-60	20-35
Wk Worthing	0-10	Silt loam	CL	A-7	0	100	100	95-100	85-95	40-50	15-25
	10-35	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-70	25-40
	35-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-95	40-65	15-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
AaA, AaB--------- Alwilda	0-12	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.20	5	3
	12-24	2.0-6.0	0.11-0.17	6.1-7.3	<2	Low--------	0.20		
	24-29	6.0-20	0.10-0.12	6.1-7.8	<2	Low--------	0.20		
	29-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low--------	0.10		
Ab*:									
Artesian---------	0-7	0.06-0.2	0.10-0.18	6.1-7.8	<2	Very high-	0.37	5	4
	7-22	<0.2	0.10-0.14	6.1-7.8	<2	Very high-	0.37		
	22-60	<0.2	0.10-0.17	7.4-8.4	2-8	Very high-	0.37		
Farmsworth------	0-6	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.37	3	6
	6-22	<0.2	0.10-0.14	6.1-7.8	4-16	High------	0.37		
	22-53	0.06-0.2	0.08-0.12	7.4-9.0	4-16	High------	0.37		
	53-60	0.06-0.6	0.16-0.18	7.4-9.0	4-16	Low--------	0.37		
BaE---------- Betts	0-5	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	0.28	5	4L
	5-24	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	0.37		
BbD*:									
Betts----------	0-5	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	0.28	5	4L
	5-24	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	0.37		
Ethan----------	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
BcA---------- Blendon	0-10	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.20	5	3
	10-34	0.6-6.0	0.11-0.18	6.1-7.3	<2	Low--------	0.20		
	34-60	2.0-20	0.08-0.15	6.6-8.4	<2	Low--------	0.20		
BcB---------- Blendon	0-10	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.20	5	3
	10-30	0.6-6.0	0.11-0.18	6.1-7.3	<2	Low--------	0.20		
	30-60	2.0-20	0.08-0.15	6.6-8.4	<2	Low--------	0.20		
Bd---------- Bon	0-32	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low--------	0.24	5	6
	32-60	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low--------	0.32		
CaA, CaB--------- Carthage	0-7	2.0-6.0	0.11-0.17	6.1-7.3	<2	Low--------	0.20	5	3
	7-27	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low--------	0.20		
	27-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
CbA*:									
Carthage---------	0-7	2.0-6.0	0.11-0.17	6.1-7.3	<2	Low--------	0.20	5	3
	7-21	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low--------	0.20		
	21-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
Clarno----------	0-7	2.0-6.0	0.14-0.17	6.1-7.3	<2	Low--------	0.20	5	3
	7-28	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	28-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
CcB*:									
Carthage---------	0-7	2.0-6.0	0.11-0.17	6.1-7.3	<2	Low--------	0.20	5	3
	7-22	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low--------	0.20		
	22-28	2.0-6.0	0.08-0.10	6.6-7.8	<2	Low--------	0.20		
	28-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
Hand----------	0-9	2.0-6.0	0.14-0.17	5.6-7.3	<2	Low--------	0.20	5	3
	9-24	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.28		
	24-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low--------	0.28		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Cd---------- Clamo	0-15	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	6
	15-60	0.06-0.2	0.13-0.18	6.6-8.4	2-8	High------	0.28		
Ce, Cf---------- Clamo	0-14	0.06-0.2	0.16-0.19	6.1-7.8	<2	High------	0.28	5	4
	14-60	0.06-0.2	0.13-0.18	6.6-8.4	2-8	High------	0.28		
CgA---------- Clarno	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	6-31	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	31-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
ChB*:									
Clarno----------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	6-31	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	31-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Bonilla---------	0-8	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low-------	0.24	5	6
	8-30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24		
	30-60	0.2-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	0.43		
CkB*:									
Clarno----------	0-9	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	9-31	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	31-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Dudley----------	0-8	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.43	3	6
	8-21	<0.2	0.13-0.19	6.1-8.4	4-8	High------	0.32		
	21-31	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate	0.32		
	31-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate	0.32		
CmB*:									
Clarno----------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	6-22	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Ethan----------	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
CoA*:									
Clarno----------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	6-31	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	31-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Prosper---------	0-11	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate	0.28	5	6
	11-30	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate	0.28		
	30-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
DaB---------- Davis	0-10	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.24	5	6
	10-37	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24		
	37-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.24		
Db---------- Davison	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	4L
	8-28	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	0.37		
	28-60	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
Dc---------- Davison Variant	0-8	0.6-2.0	0.19-0.22	6.6-7.3	<2	Low-------	0.32	5	4L
	8-60	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low-------	0.43		
DdA---------- Delmont	0-5	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-------	0.28	3	6
	5-14	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low-------	0.28		
	14-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
DeA, DeB--------- Doger	0-14	6.0-20	0.08-0.12	6.1-7.8	<2	Low-------	0.17	5	2
	14-60	6.0-20	0.06-0.10	6.1-7.8	<2	Low-------	0.17		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
DfA*:									
Dudley----------	0-8	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.43	3	6
	8-21	<0.2	0.13-0.19	6.1-8.4	4-8	High------	0.32		
	21-31	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate	0.32		
	31-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate	0.32		
Jerauld---------	0-5	0.6-2.0	0.18-0.22	5.6-7.3	<4	Moderate	0.43	1	6
	5-17	<0.2	0.10-0.15	6.6-9.0	2-8	High------	0.32		
	17-60	<0.2	0.08-0.13	7.4-9.0	4-16	High------	0.32		
Clarno----------	0-9	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	9-31	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	31-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Dh---------- Durrstein	0-1	0.6-2.0	0.17-0.20	6.1-7.3	4-16	Low-------	0.37	1	6
	1-12	<0.2	0.10-0.15	6.6-9.0	4-16	High------	0.37		
	12-60	<0.2	0.08-0.13	7.4-9.0	4-16	High------	0.37		
Dk*:									
Durrstein-------	0-1	0.6-2.0	0.17-0.20	6.1-7.3	4-16	Low-------	0.37	1	6
	1-12	<0.2	0.10-0.15	6.6-9.0	4-16	High------	0.37		
	12-60	<0.2	0.08-0.13	7.4-9.0	4-16	High------	0.37		
Farmsworth------	0-6	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.37	3	6
	6-22	<0.2	0.10-0.14	6.1-7.8	4-16	High------	0.37		
	22-53	0.06-0.2	0.08-0.12	7.4-9.0	4-16	High------	0.37		
	53-60	0.06-0.6	0.16-0.18	7.4-9.0	4-16	Low-------	0.37		
Ea---------- Elsmere	0-16	6.0-20	0.10-0.12	5.6-7.8	<2	Low-------	0.17	5	2
	16-45	6.0-20	0.08-0.10	5.6-7.8	<2	Low-------	0.17		
	45-60	0.2-0.6	0.12-0.20	7.4-8.4	<2	Moderate	0.32		
Eb*:									
Elsmere---------	0-16	6.0-20	0.10-0.12	5.6-7.8	<2	Low-------	0.17	5	2
	16-45	6.0-20	0.08-0.10	5.6-7.8	<2	Low-------	0.17		
	45-60	0.2-0.6	0.12-0.20	7.4-8.4	<2	Moderate	0.32		
Orwet----------	0-6	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low-------	0.24	4	4L
	6-60	6.0-20	0.09-0.11	6.6-8.4	<2	Low-------	0.15		
EcA---------- Enet	0-8	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low-------	0.28	4	6
	8-27	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low-------	0.28		
	27-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
EdB*:									
Enet----------	0-8	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low-------	0.28	4	6
	8-24	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low-------	0.28		
	24-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
Delmont---------	0-5	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-------	0.28	3	6
	5-12	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low-------	0.28		
	12-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
EeC*:									
Ethan----------	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Clarno----------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	5	6
	6-31	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	31-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Fa---------- Fedora	0-10	2.0-6.0	0.11-0.14	7.4-8.4	<2	Low-------	0.20	5	3
	10-15	2.0-6.0	0.10-0.14	7.4-9.0	<2	Low-------	0.20		
	15-48	2.0-6.0	0.09-0.15	7.4-9.0	<2	Low-------	0.10		
	48-60	6.0-20	0.03-0.10	7.4-9.0	<2	Low-------	0.10		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
FbA---------- Forestburg	0-6	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	6-28	6.0-20	0.08-0.10	6.1-7.8	<2	Low--------	0.17		
	28-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
FcB*:									
Forestburg------	0-6	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	6-28	6.0-20	0.08-0.10	6.1-7.8	<2	Low--------	0.17		
	28-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
Ethan----------	0-7	2.0-6.0	0.10-0.12	6.1-7.8	<2	Low--------	0.17	5	2
	7-20	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	20-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
FcC*:									
Forestburg------	0-6	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	6-24	6.0-20	0.08-0.10	6.1-7.8	<2	Low--------	0.17		
	24-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
Ethan----------	0-7	2.0-6.0	0.10-0.12	6.1-7.8	<2	Low--------	0.17	5	2
	7-20	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	20-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
HaA*:									
Hand----------	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.28		
	24-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low--------	0.28		
Bonilla---------	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low--------	0.24	5	6
	9-23	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24		
	23-33	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	0.43		
	33-60	0.2-2.0	0.12-0.18	7.4-8.4	2-8	Moderate	0.43		
HbB*:									
Hand----------	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.28		
	24-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low--------	0.28		
Ethan----------	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
HcB*:									
Houdek----------	0-8	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
	8-27	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37		
	27-60	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37		
Dudley----------	0-8	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.43	3	6
	8-21	<0.2	0.13-0.19	6.1-8.4	4-8	High------	0.32		
	21-31	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate	0.32		
	31-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate	0.32		
HdB*:									
Houdek----------	0-8	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
	8-27	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37		
	27-60	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37		
Ethan----------	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	9-24	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	24-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
HeA*, HeB*:									
Houdek----------	0-8	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
	8-27	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37		
	27-60	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
HeA*, HeB*:									
Prosper	0-11	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate	0.28	5	6
	11-30	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate	0.28		
	30-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
HfA*:									
Houdek	0-8	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
	8-27	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37		
	27-60	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37		
Stickney	0-10	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate	0.37	3	6
	10-31	0.06-0.2	0.16-0.19	6.1-7.8	4-16	High	0.37		
	31-60	0.06-0.6	0.14-0.18	7.4-8.4	>4	High	0.37		
Hk Hoven	0-3	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.37	1	6
	3-31	<0.06	0.10-0.19	6.6-8.4	4-16	High	0.37		
	31-60	<0.2	0.08-0.17	6.6-9.0	4-16	High	0.37		
HmA*:									
Hoven	0-3	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.37	1	6
	3-31	<0.06	0.10-0.19	6.6-8.4	4-16	High	0.37		
	31-60	<0.2	0.08-0.17	6.6-9.0	4-16	High	0.37		
Durrstein	0-1	0.6-2.0	0.17-0.20	6.1-7.3	4-16	Low	0.37	1	6
	1-12	<0.2	0.10-0.15	6.6-9.0	4-16	High	0.37		
	12-60	<0.2	0.08-0.13	7.4-9.0	4-16	High	0.37		
Ia*:									
Ipage	0-6	6.0-20	0.10-0.12	6.1-7.3	<2	Low	0.17	5	2
	6-60	6.0-20	0.06-0.10	6.1-7.3	<2	Low	0.17		
Els	0-8	6.0-20	0.07-0.09	6.6-7.8	<2	Low	0.17	5	2
	8-60	6.0-20	0.06-0.08	6.6-7.8	<2	Low	0.17		
Ja James	0-10	<0.2	0.10-0.15	7.4-9.0	>2	High	0.28	5	4
	10-60	<0.2	0.09-0.14	7.4-9.0	>4	High	0.28		
La Lamo	0-17	0.2-0.6	0.21-0.23	7.4-8.4	<2	High	0.20	5	7
	17-60	0.2-0.6	0.18-0.20	7.4-8.4	<2	High	0.28		
Lb Lute	0-2	2.0-6.0	0.12-0.15	6.6-8.4	<2	Low	0.24	1	3
	2-16	0.06-0.2	0.09-0.15	>7.4	4-16	Low	0.32		
	16-60	0.6-6.0	0.05-0.14	>7.9	4-16	Low	0.32		
Lc Lute	0-2	2.0-6.0	0.12-0.15	6.6-8.4	<2	Low	0.24	1	8
	2-17	0.06-0.2	0.09-0.15	>7.4	4-16	Low	0.32		
	17-60	0.6-6.0	0.05-0.14	>7.9	4-16	Low	0.32		
LdA*:									
Lute	0-2	2.0-6.0	0.12-0.15	6.6-8.4	<2	Low	0.24	1	3
	2-16	0.06-0.2	0.09-0.15	>7.4	4-16	Low	0.32		
	16-60	0.6-6.0	0.05-0.14	>7.9	4-16	Low	0.32		
Whitelake	0-8	0.6-2.0	0.11-0.17	5.6-7.8	<2	Low	0.24	3	3
	8-12	0.6-6.0	0.09-0.15	5.6-7.8	<2	Low	0.24		
	12-27	0.06-0.2	0.10-0.15	>7.4	4-16	Low	0.32		
	27-60	0.6-6.0	0.06-0.17	>7.4	2-8	Low	0.32		
Oa Orwet	0-6	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	0.24	4	4L
	6-60	6.0-20	0.09-0.11	6.6-8.4	<2	Low	0.15		
Pa*. Pits									

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Sa*:									
Shue----------	0-15	6.0-20	0.10-0.12	6.6-7.8	<2	Low--------	0.17	5	2
	15-29	6.0-20	0.06-0.10	6.6-7.8	<2	Low--------	0.17		
	29-60	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.28		
Davison----------	0-7	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	2
	7-40	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	0.37		
	40-60	0.2-2.0	0.10-0.18	7.4-8.4	2-8	Moderate	0.37		
Sb---------- Shue Variant	0-12	6.0-20	0.10-0.12	6.6-7.8	<2	Low--------	0.17	5	2
	12-36	6.0-20	0.06-0.10	6.6-7.8	<2	Low--------	0.17		
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.28		
Ta---------- Tetonka	0-14	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	3	2
	14-33	<0.06	0.10-0.16	6.1-7.3	<2	High-------	0.32		
	33-60	0.06-0.6	0.11-0.17	7.4-8.4	<4	High-------	0.32		
Tb---------- Tetonka	0-13	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6
	13-16	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.32		
	16-49	<0.06	0.13-0.19	6.1-7.3	<2	High-------	0.32		
	49-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High-------	0.32		
TcA*:									
Tetonka----------	0-13	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6
	13-16	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.32		
	16-49	<0.06	0.13-0.19	6.1-7.3	<2	High-------	0.32		
	49-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High-------	0.32		
Davison----------	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	4L
	8-28	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	0.37		
	28-60	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	0.37		
Clarno----------	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low--------	0.28	5	6
	8-30	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	30-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Td---------- Tetonka Variant	0-15	2.0-6.0	0.14-0.17	5.6-6.5	<2	Low--------	0.20	5	3
	15-19	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.20		
	19-34	0.06-0.2	0.15-0.19	6.1-7.3	<2	Moderate	0.20		
	34-42	0.2-0.6	0.13-0.16	6.1-7.3	<2	Low--------	0.20		
	42-60	6.0-20	0.06-0.12	6.6-7.3	<2	Low--------	0.20		
VaC---------- Valentine	0-5	6.0-20	0.06-0.11	6.1-7.3	<2	Low--------	0.15	5	1
	5-60	6.0-20	0.06-0.08	6.1-7.3	<2	Low--------	0.15		
Wa---------- Wann	0-8	2.0-6.0	0.13-0.18	6.6-8.4	<2	Low--------	0.20	5	3
	8-43	2.0-6.0	0.11-0.17	7.9-8.4	<2	Low--------	0.20		
	43-60	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low--------	0.15		
Wb*:									
Wann----------	0-17	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.28	5	5
	17-42	2.0-6.0	0.11-0.17	7.9-8.4	<2	Low--------	0.20		
	42-60	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low--------	0.15		
Lamo----------	0-17	0.2-0.6	0.21-0.23	7.4-8.4	<2	High-------	0.20	5	7
	17-60	0.2-0.6	0.18-0.20	7.4-8.4	<2	High-------	0.28		
WcB*:									
Whitelake--------	0-8	0.6-2.0	0.11-0.17	5.6-7.8	<2	Low--------	0.24	3	3
	8-12	0.6-6.0	0.09-0.15	5.6-7.8	<2	Low--------	0.24		
	12-27	0.06-0.2	0.10-0.15	>7.4	4-16	Low--------	0.32		
	27-60	0.6-6.0	0.06-0.17	>7.4	2-8	Low--------	0.32		
Woonsocket-------	0-12	2.0-6.0	0.14-0.17	6.1-7.3	<2	Low--------	0.20	4	3
	12-28	0.6-2.0	0.15-0.20	6.1-7.8	<2	Low--------	0.20		
	28-60	2.0-20	0.06-0.10	7.4-8.4	<2	Low--------	0.15		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Wd---------- Woonsocket	0-12	2.0-6.0	0.14-0.17	6.1-7.3	<2	Low--------	0.20	4	3
	12-28	0.6-2.0	0.15-0.20	6.1-7.8	<2	Low--------	0.20		
	28-60	2.0-20	0.06-0.10	7.4-8.4	<2	Low--------	0.15		
We---------- Worthing	0-10	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.37	5	6
	10-35	0.06-0.2	0.13-0.18	6.1-7.3	<2	High--------	0.37		
	35-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High--------	0.37		
Wk---------- Worthing	0-10	0.2-0.6	0.19-0.22	5.6-7.3	<2	High--------	0.37	5	8
	10-35	0.06-0.2	0.13-0.18	6.1-7.8	<2	High--------	0.37		
	35-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High--------	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
AaA, AaB: Alwilda	B	None	---	---	>6.0	---	---	Moderate	Low.
Ab*:									
Artesian	D	None	---	---	3.0-6.0	Apparent	Oct-Jul	High	Moderate.
Farmsworth	D	Rare	---	---	3.0-6.0	Apparent	Oct-Jun	High	Moderate.
BaE: Betts	B	None	---	---	>6.0	---	---	High	Moderate.
BbD*:									
Betts	B	None	---	---	>6.0	---	---	High	Moderate.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate.
BcA, BcB: Blendon	B	None	---	---	>6.0	---	---	Moderate	Low.
Bd: Bon	B	Frequent	Brief	Apr-Oct	>6.0	---	---	Moderate	Low.
CaA, CaB: Carthage	B	None	---	---	2.5-4.0	Perched	Mar-Jun	High	Moderate.
CbA*:									
Carthage	B	None	---	---	2.5-4.0	Perched	Mar-Jun	High	Moderate.
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
CcB*:									
Carthage	B	None	---	---	2.5-4.0	Perched	Mar-Jun	High	Moderate.
Hand	B	None	---	---	>6.0	---	---	High	Moderate.
Cd, Ce: Clamo	C/D	Occasional	Long	Mar-Oct	0-3.0	Apparent	Oct-Jun	High	High.
Cf: Clamo	C/D	Frequent	Long	Mar-Oct	0-3.0	Apparent	Oct-Jun	High	High.
CgA: Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
ChB*:									
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
Bonilla	B	Frequent	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	High	Moderate.
CkB*:									
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
Dudley	D	None	---	---	>6.0	---	---	High	High.
CmB*:									
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate.
CoA*:									
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
CoA*:									
Prosper	B	Frequent	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High	Moderate.
DaB Davis	B	None	---	---	>6.0	---	---	Moderate	Low.
Db Davison	B	None	---	---	1.5-6.0	Perched	Mar-Jun	High	Moderate.
Dc Davison Variant	B	None	---	---	3.0-6.0	Apparent	Oct-Jun	High	Moderate.
DdA Delmont	B	None	---	---	>6.0	---	---	Moderate	Low.
DeA, DeB Doger	A	None	---	---	>6.0	---	---	Low	Low.
DfA*:									
Dudley	D	None	---	---	>6.0	---	---	High	High.
Jerauld	D	None	---	---	>6.0	---	---	High	Moderate.
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
Dh Durrstein	D	Frequent	Brief	Apr-Oct	+.5-1.5	Apparent	Oct-Jun	High	High.
Dk*:									
Durrstein	D	Frequent	Brief	Apr-Oct	+.5-1.5	Apparent	Oct-Jun	High	High.
Farmsworth	D	Rare	---	---	3.0-6.0	Apparent	Oct-Jun	High	Moderate.
Ea Elsmere	A	None	---	---	1.5-2.5	Perched	Mar-Jul	High	Moderate.
Eb*:									
Elsmere	A	None	---	---	1.5-2.5	Perched	Mar-Jul	High	Moderate.
Orwet	A/D	Rare	---	---	0-1.0	Apparent	Nov-May	High	Moderate.
EcA Enet	B	None	---	---	>6.0	---	---	Moderate	Low.
EdB*:									
Enet	B	None	---	---	>6.0	---	---	Moderate	Low.
Delmont	B	None	---	---	>6.0	---	---	Moderate	Low.
EeC*:									
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate.
Clarno	B	None	---	---	>6.0	---	---	High	Moderate.
Fa Fedora	B/D	None	---	---	1.0-4.0	Apparent	Oct-Jun	High	Low.
FbA Forestburg	A	None	---	---	2.5-4.0	Perched	Mar-Jun	Moderate	Moderate.
FcB*, FcC*:									
Forestburg	A	None	---	---	2.5-4.0	Perched	Mar-Jun	Moderate	Moderate.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate.
HaA*:									
Hand	B	None	---	---	>6.0	---	---	High	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
HaA*:									
Bonilla	B	Frequent	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	High	Moderate.
HbB*:									
Hand	B	None	---	---	>6.0	---	---	High	Moderate.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate.
HcB*:									
Houdek	B	None	---	---	>6.0	---	---	High	Moderate.
Dudley	D	None	---	---	>6.0	---	---	High	High.
HdB*:									
Houdek	B	None	---	---	>6.0	---	---	High	Moderate.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate.
HeA*:									
Houdek	B	None	---	---	>6.0	---	---	High	Moderate.
Prosper	B	Frequent	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High	Moderate.
HeB*:									
Houdek	B	None	---	---	>6.0	---	---	High	Moderate.
Prosper	B	Frequent	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High	Moderate.
HfA*:									
Houdek	B	None	---	---	>6.0	---	---	High	Moderate.
Stickney	C	None	---	---	>6.0	---	---	High	High.
Hk Hoven	D	Frequent	Very long	Mar-Jul	+1-1.5	Perched	Mar-Jul	High	Moderate.
HmA*:									
Hoven	D	Frequent	Very long	Mar-Jul	+1-1.5	Perched	Mar-Jul	High	Moderate.
Durrstein	D	Frequent	Brief	Apr-Oct	.5-1.5	Apparent	Oct-Jun	High	High.
Ia*:									
Ipage	A	None	---	---	3.0-6.0	Apparent	Dec-Jun	Low	Moderate.
Els	A	None	---	---	1.5-3.5	Apparent	Nov-May	Moderate	Low.
Ja James	D	Frequent	Long	Mar-Oct	0-1.0	Apparent	Oct-Jun	High	High.
La Lamo	C	Occasional	Brief	Mar-Aug	2.0-3.0	Apparent	Nov-May	High	Low.
Lb Lute	D	Rare	---	---	1.0-5.0	Perched	Apr-Jul	High	Moderate.
Lc Lute	D	Frequent	Very long	Mar-Sep	+1-3.0	Perched	Mar-Sep	High	Moderate.
LdA*:									
Lute	D	None	---	---	1.0-5.0	Perched	Apr-Jul	High	Moderate.
Whitelake	B	None	---	---	2.0-4.0	Perched	Apr-Jul	High	Moderate.
Oa Orwet	A/D	Rare	---	---	0-1.0	Apparent	Nov-May	High	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
Pa*. Pits									
Sa*:									
Shue	C	Rare	---	---	1.0-3.0	Perched	Mar-Jun	High	Moderate.
Davison	B	None	---	---	1.5-6.0	Perched	Mar-Jun	High	Moderate.
Sb Shue Variant	C	Frequent	Very long	Mar-Jun	+1-4.0	Perched	Mar-Jul	High	Moderate.
Ta, Tb Tetonka	C/D	Frequent	Very long	Jan-Dec	+1-1.0	Perched	Jan-Dec	High	Moderate.
TcA*:									
Tetonka	C/D	Frequent	Very long	Jan-Dec	+1-1.0	Perched	Jan-Dec	High	Moderate.
Davison	B	None	---	---	1.5-6.0	Perched	Mar-Jun	High	Moderate.
Clarno	B	None	---	---	3.5-6.0	Perched	Mar-Jun	High	Moderate.
Td Tetonka Variant	C/D	Frequent	Very long	Jan-Dec	+1-2.0	Perched	Jan-Dec	High	Moderate.
VaC Valentine	A	None	---	---	>6.0	---	---	Low	Low.
Wa Wann	B	Occasional	Brief	Mar-Nov	1.5-3.5	Apparent	Mar-Jul	Moderate	Low.
Wb*:									
Wann	B	Occasional	Brief	Mar-Nov	1.5-3.5	Apparent	Mar-Jul	Moderate	Low.
Lamo	C	Occasional	Brief	Mar-Aug	2.0-3.0	Apparent	Nov-May	High	Low.
WcB*:									
Whitelake	B	None	---	---	2.0-4.0	Perched	Apr-Jul	High	Moderate.
Woonsocket	B	None	---	---	3.0-6.0	Apparent	Mar-Jun	High	Low.
Wd Woonsocket	B	None	---	---	3.0-6.0	Apparent	Mar-Jun	High	Low.
We Worthing	D	Frequent	Very long	Jan-Dec	+1-1.0	Perched	Jan-Dec	High	Moderate.
Wk Worthing	D	Frequent	Very long	Jan-Dec	+3-0.5	Perched	Jan-Dec	High	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Maximum density	Optimum moisture
											Pct		Lb/ft^3	Pct
Artesian silty clay: (S76SD-111-002)														
B21-------5 to 11	A-7-6(39)	CH	100	100	100	99	93	--	56	--	63	37	83	32
B3cacs---18 to 32	A-7-5(49)	CH	100	100	100	97	89	--	64	--	79	48	83	32
Durrstein silt loam: (S76SD-111-001)														
B22tsa----5 to 13	A-7-5(47)	CH	100	100	100	95	83	--	62	--	81	51	84	31
C1gcacs--18 to 40	A-7-6(47)	CH	100	100	100	92	81	--	62	--	82	53	88	30
Elsmere loamy fine sand: (S76SD-111-007)														
Ap, A12---0 to 16	A-2-4(00)	SM	100	99	99	97	16	--	6	--	19	NP	109	11
C2-------33 to 45	A-2-4(00)	SM	100	100	100	99	14	--	8	--	22	NP	107	14
Farmsworth loam: (S76SD-111-004)														
B21t------6 to 9	A-7-6(39)	CH	100	100	100	98	89	--	60	--	66	38	86	30
B23t-----13 to 22	A-7-6(42)	CH	100	100	100	99	92	--	66	--	66	40	89	28
C1cacs---28 to 53	A-7-6(31)	CH	100	99	98	93	84	--	53	--	58	34	97	23
C2g------53 to 60	A-7-6(09)	SC	100	99	96	75	49	--	31	--	43	27	113	15
Fedora fine sandy loam: (S76SD-111-009)														
C1ca-----15 to 30	A-6(01)	SC	100	100	100	79	39	--	28	--	29	13	118	13
C2, C3---30 to 60	A-2-4(00)	SM-SC	100	99	99	64	15	--	10	--	23	5	114	14
Hoven silt loam: (S76SD-111-005)														
B21t, B22t-3 to 24	A-7-6(31)	CH	100	100	100	99	92	--	54	--	54	30	95	22
C1g, C2g--31 to 60	A-7-6(17)	CL	100	99	99	94	76	--	38	--	42	23	106	19
Lute fine sandy loam: (S76SD-111-006)														
B21t, B22t-2 to 7	A-6(02)	SC	100	100	100	97	42	--	26	--	31	15	118	13
C2-------30 to 60	A-2-4(00)	SM	100	100	100	98	27	--	12	--	21	2	114	15

TABLE 16.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Maximum density	Optimum moisture
											Pct		Lb/ft^3	Pct
Shue loamy fine sand: (S76SD-111-008)														
A11, A12--0 to 15	A-2-4(00)	SM	100	100	100	95	15	--	6	--	20	NP	111	11
C1-------15 to 29	A-2-4(00)	SM	100	100	100	95	15	--	8	--	19	NP	112	11
IIC2g----29 to 60	A-6(08)	CL	100	97	95	85	59	--	29	--	35	18	112	16
Whitelake fine sandy loam: (S76SD-111-010)														
A1--------0 to 8	A-4(00)	SM-SC	100	100	100	91	38	--	14	--	21	5	113	15
B22tsa---15 to 19	A-6(03)	SC	100	100	100	90	41	--	28	--	35	17	108	18
C3-------35 to 60	A-2-6(00)	SC	100	100	100	86	27	--	16	--	28	11	118	13
Woonsocket fine sandy loam: (S76SD-111-003)														
Ap--------0 to 8	A-2-4(00)	SM-SC	100	100	99	79	34	--	14	--	26	6	108	18
B21t-----12 to 19	A-2-6(00)	SC	100	100	100	80	32	--	18	--	27	11	116	14
C1ca-----28 to 42	A-2-4(00)	SM	100	100	99	82	16	--	8	--	19	1	117	14

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alwilda	Sandy, mixed, mesic Typic Haplustolls
Artesian	Fine, montmorillonitic, mesic Vertic Haplustolls
Betts	Fine-loamy, mixed (calcareous), mesic Typic Ustorthents
Blendon	Coarse-loamy, mixed, mesic Pachic Haplustolls
Bon	Fine-loamy, mixed, mesic Cumulic Haplustolls
Bonilla	Fine-loamy, mixed, mesic Pachic Haplustolls
Carthage	Coarse-loamy, mixed, mesic Pachic Haplustolls
Clamo	Fine, montmorillonitic, mesic Cumulic Haplaquolls
Clarno	Fine-loamy, mixed, mesic Typic Haplustolls
Davis	Fine-loamy, mixed, mesic Pachic Haplustolls
Davison	Fine-loamy, mesic Aeric Calciaquolls
Davison Variant	Coarse-silty, mesic Aeric Calciaquolls
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Doger	Sandy, mixed, mesic Entic Haplustolls
Dudley	Fine, montmorillonitic, mesic Typic Natrustolls
Durrstein	Fine, montmorillonitic, mesic Typic Natraquolls
Els	Mixed, mesic Aquic Ustipsamments
Elsmere	Sandy, mixed, mesic Aquic Haplustolls
Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan	Fine-loamy, mixed, mesic Entic Haplustolls
Farmsworth	Fine, montmorillonitic, mesic Typic Natrustolls
Fedora	Coarse-loamy, mesic Typic Calciaquolls
Forestburg	Sandy over loamy, mixed, mesic Entic Haplustolls
Hand	Fine-loamy, mixed, mesic Typic Haplustolls
Houdek	Fine-loamy, mixed, mesic Typic Argiustolls
Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
Ipage	Mixed, mesic Aquic Ustipsamments
James	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Jerauld	Fine, montmorillonitic, mesic Leptic Natrustolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Lute	Fine-loamy, mixed, mesic Typic Natraquolls
Orwet	Sandy, mesic Typic Calciaquolls
Prosper	Fine-loamy, mixed, mesic Pachic Argiustolls
Shue	Sandy over loamy, mixed, mesic Aquic Haplustolls
Shue Variant	Sandy, mixed, mesic Typic Haplaquolls
Stickney	Fine, montmorillonitic, mesic Glossic Natrustolls
Tetonka	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Tetonka Variant	Fine-loamy, mixed, mesic Typic Argialbolls
Valentine	Mixed, mesic Typic Ustipsamments
*Wann	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Whitelake	Fine-loamy, mixed, mesic Typic Natrustolls
Woonsocket	Fine-loamy, mixed, mesic Pachic Argiustolls
Worthing	Fine, montmorillonitic, mesic Typic Argiaquolls

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